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INDIAN FISHERIES BULLETIN

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GENERAL AND DEVELOPMENT

MARINE.

(i) Progress of the Indo-Norwegian Fisheries Development Project for the quarter ending June, 1957.

The fisheries programme was revised and reorganised under Professor G. M. Gerhardsen, the new leader of the Project.

In the Health Section the routine work has been carried out in the Preventive and Curative Clinics, and, in the Medical Sub-Centre in Sakthikulangara. Fifty two new types of latrines were constructed during the quarter in the Project area.

At the Pipe Factory, 329 Premo pipes and 34 low pressure pipes were produced during the quarter.

During the quarter, Mr. Arne Nordset, the new Deputy Leader of the Fisheries Section arrived in India and joined duty. Mr. Rolf Erstad and Miss K. Falck left for Norway and were replaced by Mr. Nordset and Mrs. Gerd Satre respectively. Miss Ingrid Steinarasson, Stenographer and Mr. Bjarne Larsen, Secretary to the Leader of Fisheries, joined duty in May. Mr. G. Olsen, fisherman, has left for Norway in June after the expiry of his assignment. Professor G. M. Gerhardsen, Messrs. Asbjorn Abrahamsen, O. Brathdmen, G. Log, A. Abrahamsen and R. Drynes left for Norway on leave.

The fourth meeting of the Standing Committee was held at Neendakara on the 24th and 25th April, 1957.

Expenditure from Norwegian Funds for the period 1-4-1957 to 30-6-1957 of the financial year amount to about Rs. 10.45 lakhs. Progressive total since the beginning of the Project upto 30-6-1957 amounts to about Rs. 124.36 lakhs.

Indian expenditure for the period 1-4-1957 to 30-6-1957 of the financial year amounts to Rs. 54,803.08 n.P.

(ii) Progress of T.C.M. Fisheries Development Programme for the period 1st April, 1956 to 31st March, 1957.

T.C.M. Fisheries Development Projects have been making satisfactory progress in all the States. Equipment received by Andhra State under 1952 and 1954 Projects include one 20-ton Ice Plant and Cold Storage, 5 marine diesel engines, one insultated van, 102,000 hooks, 33 units of long lines and floats, 20 insulated containers and one 'Dan' boat. The 5 marine diesel engines fitted to Kakinada 'Nava' type boats have been operating in five Centres for demonstrating the efficiency of mechanised fishing to the

fishermen. The insulated van is being run for transport of iced fish and ice but the 20 insulated containers having been found uneconomical for transporting iced fish are being utilised at the fishing centres operating mechanised boats for storing ice. Steps are being taken to erect the Ice Plant at Visakhapatnam harbour area. The hooks are being used on the mechanised fishing boats and, long lines and floats departmentally for demonstration purposes.

In Bombay no new projects were undertaken and the only material which remained in balance of the allotment was hemp twine and fish hooks because of their high price and a subsidy of 25 per cent was granted on these two items. All items pertaining to a 10 ton Ice Plant and Cold Storage to be erected at Versova and the Quick Freezing Plant at Satpati were received and allotted to Cooperative Societies of fishermen and the construction of the building and installation of the machinery have been undertaken. The twine and the Net making machinery indented under 1952 programme started arriving during the year.

In Saurashtra region of the Bombay State the fishing vessels obtained under the Aid were conducting off shore fishing. The Ice & Cold Storage Plants are under erection at Veraval (12 ton Plant), Porbunder and Mongrol (5 ton Plants). Nylon twine and nets were distributed to the fishermen at subsidised cost and also used on power crafts for demonstration. Twenty three units of Coventry marine diesel engines and thirteen Seffle diesel 30 H.P. engines, 5 ton Ice plants, and Lampara Seine nets were received during the period. One Power vessel for Kutch and a fish-meal plant for Saurashtra are still to arrive.

At C.I.F.R.S. Calcutta, 8 films on fisheries and one 'Dan' boat were received during the period. The films are being used by the Fisheries Extension Unit. The Dan boat was allotted to the Riverine and Lacustrine Sub-Station at Allahabad. The two jeeps and trailers, which were received earlier, are being used at the two sub-stations at Cuttack and Allahabad.

The principal items received by C.M.F.R.S., Mandapam, from 1954 to 31st March, 1957 were two jeeps with trailers, one Dan boat, one 35 mm. Film Projector, one 16 mm. Motion Picture Projector with 16 mm. films. All the items are being utilised at the station in connection with Fisheries Research and Extension work.

At the D.S.F.S., Bombay, the vessels and gear were modified and improved upon the strength of the experience gained. New fishing grounds were explored and exploited and training was imparted to Indian personnel in various methods of fishing and navigation. The following equipment were received for installation in the various fishing vessels during the period: (1) Two units of Fathometer-echo depth sounder, (2) two units of centrifugal pumps, (3) three units of generating sets, (4) one unit of Northern Dragger Winch, (5) Accessories of purse seine fishing operations, but purse seine nets have not been received. In addition to the above, various items of laboratory equipment and four units of cold storge cabinets for Assam, Uttar Pradesh, Mysore and Punjab, were received. One T.C.M. Master fisherman and one Fishing Gear Technician were assigned to the Station and a Net Making School was started under the guidance of the Expert for training in net making and handling, storage of various types of fishing nets etc.

One fishing vessel and 4 marine diesel engines were received by Damodar Valley Corporation under TCM Aid while nylon twine, nets, ropes, yarn etc. are still to arrive. The equipment received are being used for survey of Tilaiya and Konar reservoirs and experimental fishing methods and exploitation.

In Kerala, the materials and equipment received under the Aid are being used for improvement and development of marine fisheries in the State. The 45 ft. Mother vessel, 32 ft. shrimp trawler, Gill net boat, and the Dan boat were engaged in conducting experimental fishing with various types of gear as shrimp trawl, gill nets and bottom set net etc. also received under the Aid and training fishermen in mechanised fishing. Two nets were loaned to Fishermen Cooperative Societies. The results of demonstration and experimental fishing have been very encouraging and resulted in the location of some good fishing grounds. Nylon were supplied to Cooperative Societies and Fisheries Training Centre. There is an excessive demand for nylon twine from the fishermen. The marine diesel engines were fitted to 4 Pablo boats and are to be distributed to the trained fishermen. The Insulated vans are being used for transport of ice and iced fish. The Ice Plant and Cold Storage are under erection. The insulated boxes were found unsuitable for transport of fish and were issued to Cochin Company on an experimental basis for storage of shrimp in ice. A few long line units were tried on board the vessel 'Sea Horse' but there has been no demand for hooks due to the high cost.

In Madras, the site for the erection of the Ice and Cold Storage Plant at Mettur Dam was selected and administrative sanction for the construction of the building was received. The insulated containers were found too heavy for transporting fish. The Yanmar Marine engine and the multipurpose winches are being utilised at the Tuticorin Training Centre for demonstration purpose.

Under the redistribution of equipment due to reorganisation of the States, two fishing vessels, 'Sardinella' and 'Gudjon', one 'Dan' boat, one Insulated van and 15,000 Norwegian fish hooks were allotted to Mysore State. Experimental trawling for prawns with the 'Dan' boat off Mangalore gave very encouraging results and have become popular among fishermen. The Insulated Van was used in the Pilot Fish Marketing Scheme organised by an F.A.O. Expert to demonstrate successfully the possibility of transporting and marketing sea fish in prime condition to the interior. 1,605 fish hooks were sold to fishermen.

Orissa has been able to fully utilise most of the equipment like hooks, nylon twine, insulated containers, Dan fishing vessel, pumps for dewatering reclaimed swamps, power winches and jeep with trailers for demonstration purposes departmentally, distribution to fishermen or hiring out to private persons for improvement of fisheries. Fish carrier launches installed with diesel engines and five 'Jolly' boats fitted with outboard motors were mainly used for fry collection and distribution work. Marine engine for beach landing craft has not yet been received.

In Uttar Pradesh the power vessel received under the Aid is being suitably modified for Seine hauling.

In West Bengal, the three bull trawlers conducted exploratory bull trawling in the grounds located by Danish Trawlers. The two insulated road vans are being used for transporting fish. Twenty insulated containers were received but nylon twine is still outstanding.

(iii) Government of India's Deep Sea Fishing Station, Bombay.

During the quarter ending June 1957, the exploratory fishing operations of the Government of India's Deep Sea Fishing Station are as follows:—

Name of vessel	Period of voyage	No. of days absent from port	Qty. of fish caught			Catch/ day's absence		
			Tons.	Cwt.	lbs.	Tons.	Cwt.	lb.
Ashok & Pratap (Cochin) . .	30-3-57 to 4-4-57	2	7	10	0	3	15	0
	5-4-57 to 11-4-57	3	8	0	73	2	13	62
	12-4-57 to 18-4-57	3	3	11	95	1	3	106
	19-4-57 to 25-4-57	2	3	14	74	1	17	37
	26-4-57 to 2-5-57	2	8	12	73	4	6	37
	3-5-57 to 9-5-57	4	11	3	110	2	16	7
	10-5-57 to 16-5-57	4	9	5	77	2	6	47
	17-5-57 to 23-5-57	3	7	5	28	2	8	47
	24-5-57 to 30-5-57	4	5	13	75	1	8	47
	31-5-57 to 6-6-57	2	1	11	19	0	15	66
Durga (Cochin) . .	29-3-57 to 6-6-57	48	26	16	100	0	11	21
Bumili (Bombay) . . .	29-3-57 to 6-6-57	36	23	4	17	0	12	100
Champa (Bombay) . .	29-3-57 to 6-6-57	29	19	2	64	0	13	22
Meera (Bombay) . .	29-3-57 to 6-6-57	39	3	13	25	0	1	98
Bangada (Bombay) . .	29-3-57 to 9-5-57	6	1	16	48	0	6	8

'Purse Seine' Fishing Vessel operating off Bombay Coast

(iv) The Government of India Quick Freezing and Cold Storage Plant at Bombay.

During the period 30th March, 1957 to 28th June, 1957 the income realised from (1) sale of ice, (2) hire of cold storage accommodation, (3) basket storage of fresh fish, and (4) freezing of fresh fish are as follows:—

	Rs.	As.	P.
1. Sale of ice (800 tons, 1 cwt. and 87·5 lbs.)	22,555	5	6
2. Hire of cold storage accommodation	12,597	0	0
3. Basket storage of fresh fish	6,600	11	3
4. Freezing of fresh fish	12,124	8	0
TOTAL	53,877	8	9

(v) New India Fisheries (Limited).

The four vessels of the New India Fisheries Ltd., Bombay, continued bull trawling operations. The landings are as follows:—

Period of voyage	No. of days absent from port.	Quantity of fish caught.			Catch/day's absence		
		Tons.	Cwt.	lbs.	Tons.	Cwt.	lbs.
Satpati & Pilottan							
1-4-57 to 12-4-57	12	74	0	0	6	3	37
14-4-57 to 25-4-57	12	77	0	0	6	8	37
12-5-57 to 22-5-57	11	76	0	0	6	18	20
25-5-57 to 28-5-57	4	16	0	0	4	0	0
31-5-57 to 11-6-57	12	71	0	0	5	18	37
13-6-57 to 24-6-57	12	65	0	0	5	8	37
26-6-57 to 10-7-57	15	56	0	0	3	14	75
Arnalla & Paj							
6-4-57 to 18-4-57	13	78	0	0	6	0	0
20-4-57 to 1-5-57	12	66	0	0	5	10	0
3-5-57 to 12-5-57	10	74	0	0	7	8	0
29-5-57 to 8-6-57	11	73	0	0	6	12	82
10-6-57 to 20-6-57	11	65	0	0	5	18	20
22-6-57 to 4-7-57	13	61	0	0	4	13	95

(vi) **Administration report of the Fisheries Department, Madras, for the year 1955-56.**

The total revenue of the department for the year 1955-56 amounted to Rs. 23,23,528-11-8 against the expenditure of Rs. 25,80,063-3-5, as compared to the revenue of Rs. 22,36,752-1-1 and expenditure of Rs. 26,05,614-7-2 in 1954-55.

Researches on the biological, hydrological and technological problems of the fisheries of the State, both Marine and Inland, were continued at the four Marine Biological Stations at West Hill, Krusadai Island, Tuticorin and Ennore, at the Freshwater Biological Station at Bhavanisagar in Coimbatore district and at the Fisheries Technological Station, Kozhikode. Meteorological, hydrographical and planktological investigations were carried out at all the stations, besides problems connected with biology, fecundity, age and shoaling of the pelagic fishes of the West Coast, specially the Oil-Sardine and Mackerel and statistical study of the trend of fisheries of the West Coast at West Hill, and studies on pearl oyster farming, fish of Rameshwaram Island and sea weeds at Krusadai. Researches on pearl and Chank fisheries at Tuticorin and studies on edible oysters and esturine fisheries at Ennore, formed the major part of the investigation at the respective Biological Stations. The investigations on pearl fisheries helped the successful organisation of the pearl fishery in February-March, 1956 and indications have been obtained on the prospects for another pearl fishing early in 1957. Factors responsible for variations in the productivity of inland waters, prevention of adverse effects of factory effluents on river fisheries, and biology and culture of Carps, Tilapia and Mirror Carp were the important themes of investigation at the Freshwater Biological Station. At the Technological Station, special attention was paid to problems on fish spoilage, canning, freezing, curing and use of anti-biotics.

Marine fish survey was conducted in Malabar and Southern Section of South Kanara Coast under the guidance of the I.C.A.R.

The Freshwater Biological Station furnished advice or material for research for a number of private persons and Institutions.

With a view to assess properly and coordinate both the inland and marine fisheries research work conducted at the Departmental Biological & Technological Stations, the Govt. constituted a State Fisheries Research Council in 1956,. After reviewing the progress of work so far done, the Council formulated programmes for each Station for a period of three years.

All the six schemes included in the First Five Year Plan were successfully implemented. 1.90 crores of fish seed were collected and distributed in 1955-56 against a target of three crores, as the collection was limited due to the unprecedental cyclone in Tanjore. The salt subsidy scheme worked satisfactorily, as several fishermen were attracted to the departmental fish-curing yards due to increase in facilities afforded to them. The target of production of 50,000 tons of cured fish was exceeded during the year by 1,070 tons.

The aim of the deep sea fishing scheme is to exploit the fishing grounds with improved crafts and tackle and also to demonstrate to the fishermen the advantages of using modern types of mechanised crafts. Against a target of 120 tons of fish, 109.3 tons of fish were caught and the nylon nets received under the T.C.M. Aid proved more durable and lasting than the age-long cotton or hemp nets. Five power fishing vessels received under T.C.M. Programme in the course of the year were also put into commission and

'Purse Seine' Fishing Vessel—Madras Coast

operated for varying periods at different places along the Coast, under the direction of an F.A.O. Fisheries Engineer.

The scheme of providing quick and cheap fish transport facilities to fishermen was highly popular and the vehicles transported 642.60 tons of fish as against 464.73 tons during the previous year. The two ice-cum-cold storage and quick freezing plants at Kozhikode and Mangalore worked satisfactorily. The plant at West Hill produced during the year 600 tons of ice besides giving cold storage facilities for 50 tons of fish and Mangalore plant produced 280 tons of ice and storage facilities for 20 tons of fish, 87,000 lbs. of prawns were frozen at West Hill Plant and 12,000 lbs. of prawns at Mangalore and exported to U.S.A. The question of opening ice-cum-cold storage plants at certain centres on the East Coast and at Mettur under the Second Five-Year Plan is being considered.

Deep sea fishing operations were carried on in the State at different Centres with four motor fishing vessels and with indigenous crafts and a total quantity of 2,65,140 lbs. of fish was caught as against 4,49,270 lbs. of fish caught during 1954-55, but the income was Rs. 26,076 against Rs. 25,773 during the previous year. The poor results were attributed to the inefficient and uneconomical old motor fishing vessels of the Department but most of these vessels have since been condemned by the Govt. and replaced to some extent by new fishing vessels allotted under the T.C.M. Aid.

Chank fishery of the Tirunelveli coast and Sivaganga Coast were operated departmentally and 5,75,961 Chanks were fished as against 4,08,388 Chanks fished during 1954-55. The Chank fishery of Ramanathapuram Coast and South Arcot and Chingleput Coasts were leased to private parties.

Pearl fishery was conducted in a small scale unlike the eloborate pearl fishery in the previous year and a total number of 2,129,058 oysters were fished and the gross revenue came to Rs. 45,455.

The production of shark liver oil was stepped upto 2,02,122 lb. as against 1,72,918 lb. in 1954-55. A modern fish meal plant was erected at West Hill; 70,671 lb. of fish manure and 30,310 lb. of fish meal were produced. 7,599 lbs. of semi-dried prawns were manufactured during the year.

There was marked improvement in transactions in the fish curing yards in the 72 yards of the State. 2,32,982 mds. of salt was consumed and the total quantities of fish let in and let out were 1,541,306 and 1,032,237 mds. respectively.

Under development and exploitation of Inland fisheries, special attention was paid to the regulation of fishing in inland waters and the licensing system of fishing was successfully continued. The revenue realised from provincialised waters was Rs. 1,72,925 as against Rs. 1,58,293 during 1954-55. The exploitation of Mettur Reservoir fisheries was re-orientated during the year by discontinuing departmental procurement and substituting a system of licensing of fishermen. A total of 122 licences were issued and the total catches were estimated at 380 tons.

The Rural Fishery Demonstration Units continued to work satisfactorily, and consequently private enterprise in fish farming has increased considerably.

The Gourami popularisation scheme was continued and a total of 20,354 fingerling of Murrels and *Etroplus* were stocked in wells as against 6,841 stocked last year. Culture of exotic Mirror Carp was continued on a large

scale in the Nilgiris. Besides sale of 6,907 lb. of this fish to the public, 1,09,908 fingerlings were distributed to other districts and to fisheries organisations of other States.

The Govt. revived the post of Fisheries Marketing & Information Officer for the quicker transport of fish, proper distribution of fish from Mettur, improvements to fish markets, marketing through fishermen cooperatives, improvement in transport procedures etc. Special attention was paid to increase the fish supply of Madras City and Madurai town. Steps were taken to induce local concerns to improve the fish markets and plans for layout of new markets and designs for display stalls were given. A study of the existing handling and transport procedures was conducted at various Centres and suitable suggestions were made to fishermen and traders with a view to prevent spoilage. 642.60 tons of fish was transported by departmental vans realising a revenue of Rs. 18,819 as against 308.48 tons and Rs. 14,172 during 1954-55. Efforts were made by the Department to popularise the departmental products like semidried prawns, fish manure, fish meal and shellgrit.

Dissemination of information pertaining to various aspects of the fishing industry was carried out by the Propaganda Unit. The department participated in 47 exhibitions, during the year. The Fishery Museum was popular and served as a medium of propaganda for the various activities of the department. The freshwater aquarium on the Marina was very popular among the public and gate collection amounted to Rs. 6,054 for the year.

The number of Fishermen Cooperative Societies increased to 259 with a total membership of 35,937 and paid up capital of Rs. 5,95,642 as against 234 co-operatives societies with a membership of 34,429 and Rs. 585,947 as paid up capital in 1954-55. A noteworthy feature during the year was the organisation of Federation of groups of societies to undertake business on an extended scale especially on the marketing side and a Federation of 18 societies has been formed in Madras. South Kanara District Cooperative Fish Marketing Society has 43 primary societies on its roll.

There were 66 schools with 12,996 pupils on the rolls and 497 teachers on the staff and these institutions worked satisfactorily.

With a view to permanently rehabilitate fishermen who were rendered homeless by sea-erosion north of Madras Harbour, the Govt. sanctioned a scheme at a total cost of Rs. 4,14,500 with adequate provision for sites and other amenities for about 200 families.

The cyclone that struck the Tanjore, Ramanathapuram and Tirunelveli coasts caused considerable havoc among the fisherfolk. Fisheries Department rendered relief measures to those who were affected by the cyclone by distribution of food stuffs, clothing etc. Besides a sum of Rs. 30,700 was given as cash relief to the fishermen for repairing 449 boats and Rs. 64,450 for yarn, sail cloth, and ropes etc.

The department continued to do its best in the Community project and National Extension Service Scheme areas. Management of fish curing yards and schools, deep sea fishing operations, shark liver oil extraction, marine fish farming, stocking of tanks, ponds and wells, demonstrations and exhibitions were the chief activities in these areas.

Under the Expanded Technical Assistance programme of F.A.O. the services of six foreign experts were made available to this State by the Government of India. Mr. Ziener, F.A.O. Naval Architect finalised the design and trial of small motorized boats the "pablo" boats and the demonstrations conducted

with the pablo-type fishing boats aroused keen interest and demand among the fishermen for such boats on account of their utility and advantages. He also completed the motorization of the Tuticorin type of fishing boat on an experimental scale. The two Naval Architects conducted experiments to evolve a suitable design for the motorised surf-landing craft. As the experiments were inconclusive, further experiments were being continued.

Mr. G. Illugason, F.A.O. Fishery Engineer located fishing grounds during the exploratory fishing conducted off Cuddalore, Adirampattinam and Nagapattinam on the East Coast and on the West Coast with modern fishing vessels and tackle received from the T.C.M. Aid. He also trained fishermen in the use of nylon gill nets.

The Harbour Specalists, Messrs. C. G. Bjuke and C. R. Bjuke, conducted a rapid survey of the river mouths and backwaters of this State.

Mr. P. A. Lusyne, F.A.O. Fisheries Training Expert, completed all arrangements for the starting of Centres at Tuticorin and Cochin to train fishermen in the use of small mechanised boats and gear. These Centres have been started since the completion of the year. Counterpart assistants were provided for the experts to assist in the investigations and for getting trained to carry on the work after the period of assignment of the Experts.

During the year, 37 papers were published by the staff of the Biological and Technological Stations.

(Administrative Report of the Department of Fisheries Madras for the year 1955-56—Government Press Madras, 1957.)

(vii) Pearl Fishery of Tuticorin, Madras State.—

A total number of 35,08,967 and 21,29,058 Oysters were fished and a revenue by sale of Oysters in auction, of Rs. 1,36,528 and Rs. 44,795 was obtained by Madras Government during 1955 and 1956 respectively. The total number of Oysters furnished is exclusive of 1/3 share allowed to the divers. In 1955, 2,297 boats and 23,821 divers were employed during 44 fishing days while in 1956 only 325 boats and 3,483 divers participated for 18 fishing days in the pearl fishing operations. The Madras Fisheries Department proposes to conduct a similar pearl fishery for a period of 2 months from 1st March, 1957 and estimation of fishable Oyster is 125 lakhs.

(Office of Adl. Director, Industries & Commerce, Madras, 7th March, 1957.)

(viii) Fisheries Statistics, Bombay State.

Marine Fisheries.—

It has been estimated that in the State of Bombay, marine fish production approximate to 1,00,000 tons per annum in years of good fishing, the total catch fluctuating considerably in unfavourable fishing seasons.

The total fishing population in the coastal areas of the State is estimated at 2,40,000 roughly, of which active fishermen were about 48,000 according to the Census report of 1951.

There are about 16,500 fishing boats including small dug-outs and "donies". Of these, about 3,000 may be between 3 to 4 tons capacity and about 2,000 of over 4 tons capacity. Even the larger boats are all open, deckless, plank-built vessels of strong construction. About 620 of these larger vessels were mechanised upto March, 1956 with in-board diesel engines and about 30 small boats operated with out-board engines. Further, about 20 to 50 are used as fish carriers, for transport of fish from distant fishing fields to Bombay Markets.

Different kinds of nets are employed to suit the local requirements and also the types of fishes to be caught. Nets commonly used in and around Bombay are bag nets, dragnets, drift nets and cast nets. Shore seines, locally called "rampan", are common in southern parts of Ratnagiri and North Kanara Coast. Hook and long-lines are used throughout the coast line of the State.

Mackerel fishery and to some extent Sardine fishery, form the main stay of the fishermen of the North Kanara and Southern parts of the Ratnagiri districts. Seer and Tuna constitute important fishery of the Northern parts of Ratnagiri district. The region around Bombay and its northern extension right up to Madwad is reputed for its pomfret, Bombay duck, Ghol and Dara fisheries. The Broach fishermen reap a rich harvest of *Hilsa* fish from the lower reaches of the Narbada river.

Inland fish culture—

Survey undertaken in some of the districts indicate that 11,000 acres comprising mainly of lakes and a few ponds are suitable for fish culture.

Artificial conditions for culturing fish are not employed except stocking smaller sheets of water with imported Carp fry of Catla, Rohu and Mrigal from West Bengal. Under natural conditions, the yield of Carps per acre of water spread varies from 400 to 1,000 lbs. per year. *Tilapia,* which is recently introduced in some of the ponds in Bombay gave an annual yield of nearly 2,800 lbs. per acre of water.

Oceanographical information—

A beginning is made to find out seasonal variations in temperature and salinity of Chowpatty Bay of Bombay; data is being collected on the principal constitutents of marine fauna and flora.

(Development Department, Government of Bombay, August, 1956.)

(ix) Report on the Exploratory Fishing in the Bay of Bengal by "Sagarika" and "Baruna" from 1951 to 1954.—

With a view to determine the best fishing grounds, proper fishing seasons, type of fish available and the types of gears most suitable for working in the Bay and training up of Indian personnel in fishing with power vessels, the Government of West Bengal brought two wooden Cutters "SKARREKLIT" and "CHRISTIAN SCHRODER" from Denmark in December, 1950 which were subsequently renamed as "Sagarika" and "Baruna". The two vessels commenced their fishing voyage on the 26th December, 1950.

Fishing operations and their results—

Year	No. of voyage	No. of days of absence from port	Total No. of hauls	Average No. of hauls per day	Total catch (in Mds.)	Average catch per day of absence) (in Mds.
1951 . . .	19	330	1,526	5	8,800	26·6
1952 . . .	16	278	1,185	4	7,883	28
1953 . . .	15	210	1,015	5	9,506	45
1954 . . .	13	190	862	5	8,637	45·5

During the period 1st January, 1951 to 30th November, 1954, they made 63 voyages staying out of port for 1,008 days. The total number of hauls was 4,588 and the total catch obtained during the period was 34,133 mds. and the average catch per day of absence from port was about 34 mds.

The field of operations of the two vessels during these 4 years abounded the areas of the following description:

South-West	Gopalpur area (19′ 22″ Lat. 85′ 11″ Long.)
North-East	Mouth of Eastern Chanal (21′ 11″ Lat. 89′ 13″ Long.)
North	Mouth of Hooghly river area (20′ 52″ L t. 87′ 36″ Long.)
South	Bl ck P goda are . (19′ 55″ Lat. 86′ 32″ Long.)

The maximum number of operations were carried out in western channel, mouth of Mahanadi and Devi river areas, Black Pagoda area and the mouth of Chilka. Of these fields, mouth of Devi river, Mahandi, Prachi river and Black Pagoda areas were established to be best pontential fishing grounds. During these exploratory operations about eleven potential fishing grounds were established within an area from Ganjam to Malta point.

Experiments were conducted with Haddock trawl, prawn trawl, floating trawl and drift nets; Haddock trawl was found to give satisfactory results. Besides exploratory operations, a batch of local fishermen were trained in net making and operation of nets.

Depth of operations during these 4 years varied from 4 to 56 fathoms. Fishing operations indicated that the potential fishing grounds lie between 10 to 30 fathom lines.

The exploratory fishing showed that catch became too low in monsoon months of June and July. Because of the rough seas the loss of gear was the maximum during this period. It was also observed that gradual reduction in the quantity of catches started with the advent of southern wind from April and was lowest during June and July continuing till the end of August. In December and January the catch reached its peak.

The major bulk of the fish catches may be grouped under the following groups: (1) Carangidae, (ii) Sciaenidae, (iii) Clupeidae, and (iv) Kurtidae.

Caranx & "Chandas" (*Leiognathus* sp.) were caught generally from the grounds between Black Pagoda area and Puri Coast throughout all the seasons. with the peak season from February to September.

Bhola (Sciaenidae) was obtained in high percentage particularly during spring and summer from the grounds from western channel to Black Pagoda and between the mouths of Devi and Prachi rivers.

Clupieds and Mullets (*Upenoides* sp.) were caught throughout the year with greater abundance during winter months between Black Pagoda and Puri area. Clupeids were also abundant between western channel to Malta Point. Catch of *Kurtus indicus* was steady between the mouths of Devi and Prachi rivers, being maximum during winter months.

Eels (*Muraenesox* sp.) were available from almost all the grounds surveyed, their percentage in the catch being high during monsoon or when the sea became rough due to changes in meteorological conditions.

Bombay duck (*Harpodon nehereus*) was found to be almost a constant factor in the catch composition in the grounds between Puri and Malta Point, irrespective of season and were abdundant in winter from the areas within Devi and Prachi rivers. It was not found in Chilka point or further down south.

The high quality fish obtained from the area so far surveyed were Pomfrets (*Stromateus* sp.), Mackerel (*Rastrelliger canagurta*) perches (*Lutjanus* spp., *Pristipoma* spp.), Prawns (*Penaeus carinatus* and *Penaeus indicus*). These fish were available almost throughout the year in all the grounds but in small quantities, although percentage of Pomfrets, Mackerel and Prawns in the catches increased from November to March. Potential grounds for all these fish were from False point to mouth of Chilka or upto Gopalpur, though a good catch of Mackerel was also available from the area between Western channel and Malta Point.

INLAND.

(i) Report on First Five Year Plan for the year 1955-56 of West Bengal.—

Progress in the development of derelict and semi-derelict water areas by advancing loans to their owners has not been appreciable due to co-shareship complications, want of suitable areas with acceptable rights and titles, inability of the owners to furnish adequate security against the loans, etc. Upto 1954-55, one beel of about 182 acres has been developed at a total cost of Rs. 1.03 lakhs, wherefrom an additional production of 81 tons of fish is expected annually. No new beel could be taken up during the year 1955-56.

It is now contemplated to undertake improvement of State and private owned beels obtained through requisition or on mutually agreed terms, departmentally and subsequently, to recover the amount so spent within a period of about 15 to 20 years or so, either by leasing out the developed beels to fishermen Organisations, other suitable private pisciculturists on reasonable rent or by exploiting the same departmentally.

325 acres of derelict and semi-derelict waters were improved during 1955-56 at a cost of Rs. 1.56 lakhs, bringing the total area of water reclaimed during the plan period to 2,698 acres by advancing medium term loans at an estimated cost of Rs. 9.87 lakhs. It was expected to have an additional production of 1,109 tons of fish annually.

By advancing short-term loans, 372 acres of water were developed for pisciculture during 1955-56 at a cost of Rs. 1.13 lakhs bringing the total to 8,458 acres during the Plan period at an expenditure of Rs. 16.32 lakhs, from which an additional production of 4,204 tons of fish was expected annually.

About 445 bales of yarn and 353 fishing boats were distributed to needy fishermen at subsidized rates during the Plan period of which 102 bales of yarn and 77 fishing boats were distributed during the year 1955-56 at a total cost of Rs. 55,000.

It is contemplated to grant production bonus to the private fish culturists to encourage the production of fry and fingerlings through private agencies.

Detailed statistics with regard to fishery resources such as their number, nature and intensity of distribution in different regions were collected since 1954-55, and is likely to be continued till 1958-59. During the last year of the first Plan, about 1,500 acres of water areas in 71 'mouzas' were surveyed at a cost of Rs. 20,000.

Researches were carried on the following problems with encouraging results:

Experiments were conducted to reduce fish fry mortality during transport with the use of chemical absorbents in the medium under oxygen pressure, thus, reducing the mortality to less than 10% during long distance transport. A large number of cases of fish mortality in tanks arising out of sudden changes in the meteorological conditions as well as parasitic infection were satisfactorily handled by treating the tanks, with potassium permaganate-lime mixture in the former case and gammaxene in the latter, as could be found effective during laboratory investigations and field trials.

Useful information were collected on the limiting factors governing the breeding of Indian Major Carps in "Bundh" fisheries, which will be useful in establishing artificial breeding centres in rural areas.

Study on limiting factors, such as sewage concentration, stocking intensity, stocking proportions, etc., in the control and managemet of sewage irrigated fisheries was conducted. Studies were also conducted on—

(1) the possibility of culturing hill stream species of fish, *viz.*, "Katli" in confined waters and studying its food and feeding habits;

(2) paddy-*cum*-fish culture—its relative advantages and disadvantages with respect to growth and yield of paddy; and

(3) optimum stocking ratio, stocking intensity and other limiting factors in pond fisheries.

The following products were prepared at the Government Technological Station at Jounput near Contai sea coast at a total cost of Rs. 1.23 lakhs during the Plan period of which an amount of Rs. 21,000 was spent in 1955-56.

	1950-51	1955-56
(i) Shark liver oil	0·25 lakh lbs.	00·08 lakh lbs.
(ii) Fish meal	1·48 ,, ,,	0·39 ,, ,,
(iii) Processed fish	0·11 ,, ,,	0·03 ,, ,,
(iv) Fresh fish as byproducts . . .	1·11 ,, ,,	0·39 ,, ,,

With a view to educating the fish farmers in the improved methods of pisciculture, 119 demonstration fish farms were started during the Plan period at a total cost of Rs. 61,000 of which 61 farms were opened in 1955-56 at a cost of Rs. 39,000.

The Danish trawlers have been working since 1950 for charting out fishing grounds, standardisation of fishing gears and training of Indian personnel in the technique of power fishing. This exploratory fleet has also been strengthened by addition of three Japanese Bull trawlers procured under the T.C.M. Programme with 36 Japanese technicians since March, 1955.

Till the end of the Plan period, these five trawlers performed 166 exploratory trips and brought 1,652 tons of fish; during 1955-56, they performed 60 trips and brought 428 tons of fish. In addition to charting out 11 potential fishing grounds, standardisation of gear and study of seasonal fluctuations, 43 Indian personnel had been trained to take up work on board the trawlers. It is contemplated to construct a jetty with necessary feeder road, staff quarters, ice plant and cold storage at Kakdwip in the down Hooghly area, nearer to the sea.

Of the total expenditure of Rs. 25.37 lakhs incurred during the Plan period, a sum of Rs. 8.29 lakhs was spent in the year 1955-1956.

(ii) Achievement of Fisheries Development during the First Five Year Plan of Tripura State.

Out of the provision of Rs. 1.37 lakhs, a sum of Rs. 1.03 lakhs was spent. 123 acres of water areas were reclaimed during 1951—56 (First Plan Period) against a target of 150 acres and 150 mds. of fish was produced against a target of 1,500 mds. 1 Fishery Development Officer and office staff were appointed.

(iii) Fish Culture in Uttar Pradesh.

Considering the importance of fish culture as an integral part of rural economy, the State Fisheries Department have taken over large sheets of water of 3 acres or more in area for fish culture, while the small village ponds have been placed at the disposal of the "Gaon Sabhas" with a view to encourage private enterprise with the assistance and technical advice of the fisheries staff. However, fishing was allowed free or under certain restrictions before the abolition of Zamindari in this State, the practice has been allowed to continue, as it is intended that people, particularly fishermen, should continue to enjoy the privilege of free fishing, which they were enjoying prior to the enactment of the U.P. Zamindari Abolition and Land Reforms Act, 1950.

About 2.58 lakhs fingerlings have been supplied to the various "Gaon Samaj" and private pisciculturists in the State for stocking in their tanks during 1955-56 against a supply of 5,400 fingerlings during 1951-52. During the Second Five Year Plan period, it is proposed to lay great stress in this sphere and to induce private pisciculturists in the State to take up fish seed at a subsidised rate of Rs. 4 per 1,000 ex-departmental nursery. It is also proposed to give 50% subsidy on the actual transport provided the transport is arranged by the State Fisheries Department. It is envisaged that during the Second Plan period about 100 lakhs of fish seed would be supplied to private pisciculturists.

Steps are also being taken to organise fishermen into Cooperative Societies and to provide them grants-in-aid to the extent of Rs. 10,000 per party, out of which 50% will be towards the improvement of nursery ponds, stocking tanks, etc., and the balance for the purchase of modern fishing equipment. It is envisaged that during the Second Five Year Plan period about 114 Societies in the State would be provided with such financial assistance.

TECHNOLOGY.

(i) A simple scientific fish-liver-oil extractor for production of A-vitaminised oil.

A simple fish-liver oil extractor has been designed and constructed on the following principles:— (a) The extractor should be very simple in construction so that the fishermen can use it without any difficulty. (b) The cost should be kept as low as possible. (c) To increase the extraction efficiency and to avoid under-cooking, heating should be done by direct steam without the installation of separate boiler. (d) Extraction should be done in the absence of air to avoid loss of vitamin due to oxidation. (e) The extractor should be portable, so that the fishermen can carry it wherever they like. (f) It should be usable even on country craft at seas. (g) The extractor itself should facilitate separation of the extracted oil with minimum trouble. (h) Design of the extractor should be such that it can be constructed with varying

capacities, to deal conveniently with any quantity of liver from 5 to 100 lbs. (2.27—45.4.kg.) without loss in efficiency.

In this extractor heating of the macerated liver can be done by live steam and in the absence of air, without installing a separate boiler.

(Saha, K.C.—Indian Journal of Fisheries, Vol. III, No. 2, October, 1956.)

(ii) Chemical investigations on the formation of pearls in the Indian Pearl Oyster (*Margaritifera Vulgaris*).

The formation of the pearls has been attributed to the presence of some parasitic worm (live or dead) or sand grain or other irritants or some foreign nucleus that gets into the bivalve over which the oyster sheds its nacreous secretion in layers. Information on the chemical factors that affect or otherwise promote the formation of pearls in the oysters is lacking. Experiments were conducted on 10 samples each of 100 oysters out of the daily catches at Tuticorin. The meats were divided into the following portions:

(1) having fairly good-sized pearls, (pepper or pea-sized pearls); (2) having seed pearls (*i.e.*, very small ones of the size of mustard or sand grains) and (3) having no pearls. Chemical composition of three portions of meat is almost the same except for the iron content. The iron content of the meat without any pearls is nearly seven times that of the meat with big pearls. The amino acid make-up of the protein from the different portions of the meat does not show much variation. Therefore, the chemical constituents like protein, fat, ash, phosphorous and calcium in the meat and also the amino-acid composition of the protein fail to indicate the factors responsible for the formation of the pearls.

(Venkataraman, R. and Chari, S. T. J. Sci. Industrial Res. Vol. 15C., p. 212-213. September, 1956.)

(iii) Amino acid in prawn from Bombay.

A comparative study of the amino acid contents of chitin and muscle of *Palaemon malcolmsonii* was made by using circular paper chromatography. The chromatograms were developed with patridge's solvent, then sprayed with 0.4% ninhydrin in acetone.

The color developed in 30 min. The separate bands were cut out, and the color was eluted with 4 ml. of 75% ethyl alcohol, containing 0.2 mg. of CuSo4:5H20. The intensity of color was measured with a Klett-Summerson photo-electric colorimeter with a green filter. From hydrolyzates containing an equivalent of 15 mg. of N, the following amounts (%) of amino acids were obtained (in muscle, chitin): leucines (7.7, 5:9); phenylalanine (5.3, 4.8), tyrosine (3:4, 4:0), alanine (5.4, 6.9), arginine (8.2, —), histidine (3.5, 6.2), lysine (6.2, 6.5), and cystine (2.5, trace) resp.

(FAO World Fisheries Abstracts, Vol. 7, No. 2 p. 47, March/April, 1956).

MARINE FISHERIES RESEARCH

Progress of Research work done at the Central Marine Fisheries Research Station, Mandapam for the quarter ending June, 1957.

Fishery Survey—

A new survey centre was opened at Gangoli on the Mysore coast and the survey centre at Kakinada was reopened bringing 19 additional fishing villages under observation.

The total landings of marine fish in the first quarter during January to March 1957 was 172,620 metric tons as compared to 140,151 metric tons during the corresponding period in 1956. The increase in total landings was mainly due to increased landings of Oil Sardine and Mackerel in Kerala and Mysore, and Bombay duck and Coilia sp. in Bombay zone. An important feature of Oil Sardine fishery was that good catches were obtained in Ratnagiri, Kolaba and Bombay districts of Bombay. The landings in Andhra declined mainly due to total failure of Red mullet fishery and reduced catches of Sciaenids and Clupeids, other than Sardimes. *Leiognathus* and *Lactarius* fisheries were considerably poor throughout India. The highest average catch of 5.28 kgm. per man hour was noted in Central Bombay zone and lowest in North Andhra zone with 0.57 kgm.

Fishery Biology—

At Mandapam biometric and morphometric investigations on Mackerel were made in connection with the population study of the species. Studies on length frequency and maturity of *Sardinella gibbosa* and *S. albella* constituting the 'Choodai' fishery and breeding cycle of *Hemiramphus* were initiated.

At Kozhikode, the determination of age by scales, maturity and feeding activity of juvenile Oil Sardine were carried out. Diatoms were the dominant food organisms, *Biddulphia mobiliensis* and *Fragilaria oceanica* being the most important one. The zooplankton formed a negligible fraction of the stomach contents. A significant point noticed regarding the Mackerel fishery was that while higher landings were reported at the northern fishing centres like Quilandy and Badagara than at Calicut, the fishery was a failure at Tanur. Zooplankton constituted the main food of Mackerel.

Investigations on the 'Over fishing problem' in the inshore waters of Kozhikode were continued.

Observations of off-shore fisheries at Kozhikode showed that M.L. 'Durga' made 73 voyages in off-shore waters off Kozhikode and landed 34.233 tons of fish of which 11.577 tons were prawns. At Bombay during April to June 1957 'Champa' and 'Bumili' made 31 and 40 voyages operating otter trawls landed 47,407 lbs. and 27,836 lbs. respectively. The catch per hour of trawling for 'Champa' ranged between 288.8 and 330.0 lbs. and for 'Bumili' between 211.9 and 290.2 lbs. 'Meera' operating gill nets landed 8,038 lbs. in 39 voyages. The trawlers of New India Fisheries Ltd. operating as bull trawlers landed 16,32,205 lbs. of fish and the catch per haul varied from 1,993.509 lbs. to 2274.202 lbs.; the landings of 800 lbs. of Tunnies in May is of great significance. 'Bangada' made an exploratory trip for long-line fishing.

Biological studies were carried out on the species composition, maturity and size of the species constituting the Pomfret fishery and Prawn fishery in Bombay. Intensive investigations on the species contributing to "Dara" fishery of Bombay and Saurashtra coast have been taken up.

Observations on the species composition of marine prawn catches at Narakkal and collection of more biological data in connection with the studies on the problem of recruitment and studies on *Penaeus indicus* and Penaeid post-larvae and back-water prawn fishery have been going on at the Prawn Research Unit, Ernakulam.

Studies on off-shore fisheries were continued at Cochin from the catches by the Government of India Cutters, 'Ashok' and 'Pratap' and shrimp trawler, 'Durga' and by the schooners and the other mechanised fishing vessels of the Indo-Norwegian Project.

Observations on the general fishery conditions at Karwar showed a substantial increase in landings with 90,348 lbs. as compared to 29,602 lbs. for the corresponding period in 1956. Intensive study was undertaken to find out whether young Mackerel occur in Karwar inshore waters. The length frequency study of Oil sardine was carried on 2,543 specimens.

Observations were carried out at Mangalore and at Neendakara on the general fishery conditions, and inshore and off-shore fisheries in these areas.

At Vizhingam, the length frequency studies of Mackerel showed three dominant size groups 4-5 cm; 13-15 cm; and 23-24 cm. Sex ratio studies revealed a preponderance of females.

At Calcutta the observations on the trawling operations in the Bay of Bengal showed that yield at Devi river mouth was the highest and that at Prachi river mouth was encouraging; *Kurtis indicus* and sciaenids formed the bulk of the catches.

At Waltair, studies on the maturity and breeding of *Thrissocles mystax* indicated that this species has a definite spawning period. Study of the biology of *Scomberomorus guttatus* was commenced.

At the Molluscan Research Unit, Madras, a new scheme to study the "Transference of seed clam from the Adyar estuary to the Cooum estuary and study of the rate of growth and density of population with a view to exploring the possibility of reclamation of depleted beds and formation of fresh beds" was initiated. A survey of the Cooum estuary was started in connection with the noted depletion of *Meretrix casta*. Work on the special scheme on the problem of overfishing on the Madras coast was undertaken.

Marine Biology:

Marine biological studies at Mandapam with special reference to plankton of Gulf of Mannar and Palk Bay showed that the most striking difference noted between the zooplankton of this and the last quarter was that there was a complete absence in the former of pteropods and cladocerans all of which appeared abundantly in the latter. Work on the artificial culturing of a few selected species of diatoms was started.

Work on plankton at Kozhikode showed that zooplankton constituted the bulk and copepods constituted the dominant part, while *Fragilaria oceanica* and *Biddulphia mobiliensis* formed the bulk of phytoplankton. Hydrological studies indicated marked fluctuations in the pH of the waters.

Hydrological studies on sea water samples of coastal waters are in progress at Bombay, Cochin, Karwar and Madras.

Physiology and fish farming:

Experiments on the metabolism of *Plotosus sp.* and trial experiments on *Chanos* and *Tilapia* fry are in progress and the apparatus was suitably modified for experimenting with small sized fish.

Bacteriology:

Studies were carried out on (1) nitrogenous extractives of fish muscle, (2) denaturation of fish proteins during freezing and (3) keeping quality of iced fish under varied conditions of handling.

Algology:

Studies on agarophytes indicated that admixture of *Gelidium* with *Hypnea* has the effect of bringing down the S.T. without reducing gel strength and if *Hypnea* agar is prepared as to increase both gel strength and its natural setting temperature of 26°C, it would assume commercial importance, because of the abundance of the resource in Indian waters. Storage of *Graciloria lichenoides* in dry, sun bleached state under proper conditions was found to yield a high grade of agar showing that proper storage is conducive to better agar quality. Studies on the growth and succession of algae on a coral substratum in the intertidal zone are in progress.

Fish Curing and Fishery Bye-products:

Experiments on the influence of humidity conditions on the keeping quality of salt fish are in progress. Studies on the possibilities of improving indigenous curing methods by incorporating harmless preservative chemicals indicated that Propionic acid may prove to be useful in controlling the phenomenon of reddening and mold growth in wet-salted fish.

Chemical analysis of fish meal prepared from different varieties of fishes indicate that samples prepared by fermentation method do not develop free ammonia or show any substantial increase in the total volatile nitrogen and peroxide values even after storage for 10 months.

Preliminary experiments were conducted for the preparation of protein from fish wastes. It has been possible to work out a formula for the preparation of a strong jelly from sodium alginate for coating fish before freezing which helps to minimize dehydration of stored fish.

Detailed investigation on the use of copper alginate as a preservative for fishing nets have been started.

(Central Marine Fisheries Research Station, Mandapam Camp).

Fishery Biology:

(i) Preliminary studies on the Biology of the Palaemonid Prawn, *Leander styliferus* Milne-Edwards:

Leander styliferus Milne-Edwards is one of the few economically important palaemonid prawns of the deltaic regions of West Bengal, the fisheries of which are of considerable commercial value. The species is smaller than the more common prawns, growing to a size of only about 110 mm.

An account of its distribution and habitat, food and feeding habits, length-weight relationship, egg carriage and breeding, sex ratio, parasitization and length-frequency distribution is given. A brief note on its fishery in West Bengal is also presented in the paper.

The prawn mainly feeds on small Crustaceans, and larval fish together with an appreciable quantity of bottom debris. The weight of the prawn is found to increase at a rate slightly less than the cube of its length. At the breeding time the species migrates seaward and the young ones are liberated in the sea. The females are predominant in the catches almost throughout the year. A bopyrid parasite, *Bopyrus squillarum* Latreille, var. *bimaculatus chopra* has been very frequently noticed in the branchial chamber of *L. styliferus* In the infected individuals the gonads are found to the rudimentary and imperfectly developed, and the parasitized females are never seen carrying

eggs even when they are of adult size. A suggestion is made regarding the probability of sex reversal due to parasitism.

(Kunju, M.M.—Proc. IPFC/C55/Sym.6, October, 1955, Tokyo).

(ii) Studies on the age and growth of the Malabar sole, *Cynoglossus Semifasciatus* day.—

Malabar sole, *Cynoglossus semifasciatus* forms a valuable fishery along the Malabar Coast and for the development of a scientific management policy for any fishery, it is essential to know the rate of growth of the species concerned and the changes in the age-composition of its stocks from season to season and from year to year.

This paper deals with the age and rate of growth of *Cynoglossus semifasciatus* on the basis of data collected from samples from the inshore fishing grounds at West Hill, Calicut, during the period April, 1949 to March, 1952.

The 'monsoon' rings found on the scales of this species, which indicate the seasons when growth ceased temporarily, have been used in the analysis of the year-class composition of the fishery; data on these rings used along with the percentage frequency distribution of the different sizes in random samples during different months of the period have been useful in assessing the rate of growth of the species.

The bulk of the commercial catches of Soles during the years 1949-50, 1950-51 and 1951-52 consisted of individuals that had a single monsoon ring, the older individuals being negligible in proportion. The products of spawning of a particular fishery season grow up to the commercial size and directly enter the fishery in the very next season.

During the September-October, fishery season in 1949 and 1950, the size-group with the highest frequency was 10-10.9 cm; but in fishery season of 1951 this was 12-12.9 cm. thus showing a higher growth. This was correlated with a decrease in the total catches of the area.

The length frequency studies indicated a higher growth for the females than males. A decreasing growth rate has been noticed with increasing sizes. The females were more numerous than males in the highest sizes and all individuals found above 16.2 cm. were females. No individuals were found in this region during the entire period of investigation, with more than two rings on their scales.

(Seshappa, G and Bhimachar, B.S., Indian Journal of Fisheries, Vol. I, Nos. 1 & 2, 1954).

(iii) Fish and Fisheries of the Chilka Lake with Statistics of fish catches for the years 1948—50.

In this paper an attempt has been made to list the fish fauna of the lake, describe its important fisheries and fishing industry. On the basis of the available data the biology of the fishes and their distribution in the different zones have been interpreted and the production capacity of the lake as a whole in terms of yield per acre estimated.

It is evident from the available records that exports of fresh fish have been maintained at a steady level from 1930—39 with a tendency on the whole to

rise but there was a decline for the years from 1940 to 1942. Export of fresh fish in relation to the total production from the lake is fairly high.

The lake is an uncultivated piece of water, more than a fourth of its area being too shallow to sustain any good fishery of economic importance. The yield per acre of different groups of fish appears to fluctuate and the average yield is not equal to 1/3rd of the total yield from the three zones which are of unequal size.

The division of the lake into three zones based on the differences in the ecological conditions throws some light on the distribution of fishes in the lake and their seasonal abundance in successive years.

The productivity of different groups of fishes appears to fluctuate except in the case of mullets. As far as mere bulk in production is concerned prawns, clupeoids, miscellaneous fishes and the mullets occupying the top rank throughout the period of investigation. The yield of prawns has been most spectacular; Clupeoids, Perches and Thread fins have shown increase while the miscellaneous fishes have shown a downward trend. Two important groups, Catfishes and Sciaenids have registered a decline.

The total production from the Lake during the three years has been estimated at 1,07,270.86, 98,253.25 and 92,713.36 maunds respectively. In spite of the progressive decline in yield fresh fish exports have risen while the production of dried fish has progressively declined.

There has been a downward trend in the yield of fishes while there has been big increases in the catches of prawns. Possible reasons for these are discussed and conservation of the existing stocks of fish and the following measures of abolition of zamindari rights, literacy and mass education of fishermen, modifications in the system of Jano fishing, size limit of fish for exports to check indiscriminate fishing and to ensure a uniform supply of good sized fish all through the year, carps, mullet and prawn culture in embanked areas, improvement in transport, Ice depot and fish purchasing agency at Satpara, improvements in communication, marketing systems, use of standard weights and measures, improvements in handling of fish, proper Railway facilities, disposal of fish at Calcutta and collection of statistical and biological data for planning and development of the fishing industry are suggested for tentative adoption.

(Jones, S., and Sujan Singani, K.H., Indian Journal of Fisheries, Vol. I, Nos. 1 & 2, 1954.)

(iv) On the Mouth-breeding Cichild *Tilapia Mossambica* Peters.

A brief account is given of our existing knowledge and some new observations on the mouth-breeding Cichild fish, *Tilapia mossambica,* with reference to its adaptability, food and feeding, sex differentiation, breeding habits and larval stages.

This fish exhibits remarkable adaptability to brackish water conditions. Althuogh *Tilapia* is not as adaptable as the milk fish *Chanos,* it is beyond doubt that the fish can tolerate a wide range of salinity from purely fresh-water to waters of as high a salt concentration as 3.0—4.8 per cent.; and can grow and breed under these conditions. The great advantage in this salt tolerance can be appreciated when we consider the fluctuations in salinity to which many of the natural lagoons along our coast are subjected during different seasons of the year.

As in the absence of its usual plant food (diatoms and algae) the species is able to feed on larval crustacea, insect larvae and worms, it has better chances of thriving than a purely vegetarian or carnivorous species.

The fish starts to propagate at the age of about two months, an amazingly short period compared to many other tropical fish. Their parental care also ensures a good percentage of survival of the fry. Owing to the frequent spawning by the fish, overcrowding in the ponds may occur and the larger fish should be periodically removed to prevent over-population.

Among other advantages, mention is made of the utility of *Tilapia* to keep down the hatching of anopheles mosquitoes in brackish water ponds, as the fish eat away masses of filamentous green algae which are the usual hinding places of mosquito larvae. Adaptability of *Tilapia* to brackish water conditions, its omnivorous habits, rapid growth and quick breeding as compared to many of our indigenous species etc. are briefly discussed and the suitability of the fish for culture in India based on information gathered so far, is examined.

(Panikkar, N.K., and Tampi, P.R.S., Indian Journal of Fisheries Vol. I, Nos. 1 & 2, 1954.)

(v) The food and feeding habits of the Grey Mullets, *Mugil parsia* **Hamilton and** *M. speigleri* **Bleeker.**

The food and feeding habits of the Grey Mullets, *M. parsia* and *M. speigleri*, were studied for a period of one year, from marine and estuarine environments. Samples of *M. parsia* from a brackishwater bheri were also examined. It was found that the food of both the species was basically the same consisting of decayed organic matter, algae (chlorophyceae and Myxophyceae), and diatoms from the benthic zones of their habitats. Miscellaneous food materials of animal origin consumed by the fish consisted mainly of copepod and polychaete remains. The stomachs of all fish other than the early juveniles contained sand grains which were ingested mechanically while feeding at the bottom. Observations on Mullets reared in aquaria have confirmed them to be bottom feeders. The early juveniles feed at the surface in shallow areas, for a short period, before changing over to bottom feeding habit when the young are about 25 mm. long.

Seasonal fluctuations were observed in the volume and composition of food consumed by *M. Parsia*. These fluctuations are correlated with the relative abundance of these food materials in the environments. The proportionate length of alimentary tract of *M. parsia* in the bheri was significantly greater than in other environments, probably an adaptation for the proper digestion and absorption of the tough filamentous algae that predominated in the diet in this environment. From the study of the condition of feed of Mullets examined in different seasons, it is inferred that there is a remarkable enhancement in the intensity of feeding during winter, and a lowering of it in the rainy months. The increased feeding intensity in winter corresponds to the period of general abundance of algal blooms in these waters. During the rainy season there is considerable agitation and disturbance of the benthic flora and this is probably the reason for the fall in feeding intensity at this time.

A comparison of these data with those obtained from a study of a sample of *M. parsia* obtained from Visakhapatnam on the Coromandel Coast shows very little difference in the food habits of Mullets in different localities.

(Sarojini, K. K., Indian Journal of Fisheries, Vol. I. Nos. 1 & 2, 1954.)

(vi) The Perch-fishery by Special traps in the area around Mandapam in the Gulf of Manner and Palk Bay.

One of the indigenous methods of fishing prevalent in the Gulf of Mannar and Palk Bay is by the employment of traps, known locally by the name "koodu", primarily intended for catching percoid fishes. Among the 23 species of fishes caught in perch-traps, only 18 species were true Perches. From a study of the percentage composition of the different species caught in perch-traps, *Lethrinus Cinereus* was the main species occuring in the catches from both the areas followed by *Callyodon ghobban*, a non-perch from Gulf of Mannar and *Teuthis marmorata* in Palk Bay. The percentage of non-perches in the traps in the Gulf of Mannar was 26.28, whereas in Palk Bay catches it was only 0.36.

The daily average catch per trap per day was found to vary from 0.07 to 1.86 lb. and the average catch per trap per day in Gulf of Mannar was observed to be 0.3 lb. and in Palk Bay 1.1 lb. The average catch per trap per day was found to have a good correlation to the nature of bottom, the depth at the fishing place and its distance from the shore. Temperature and specific gravity of sea water at the fishing place were not found to have any influence on the average catch per trap. Effect of different kinds of baits on Perch catches has been discussed. The annual total yield through perch-traps in the Mandapam area of the Gulf of Mannar and Palk Bay was estimated to be 47.28 tons.

Observations made on the gonadic condition of the different species have shown that most of the species caught in perch-traps are immature except *Psammoperca Waigiensis*, *Pelates quadrilineatus*, *Therapon puta* and *Upeneoides tragula* in which gonads in advanced stages of maturity were also observed. The length-weight relationship in 5 important species caught in perch-traps was found to show the normal pattern, the weight increasing as the cube of the length. Examination of the stomach contents of the different species indicate that all the species caught in traps are either bottom feeders or browsers.

From analysis of variance, it has been observed that though the multi-faced trap is superior to the single-faced trap in catching ability, there is no evidence of gain in superiority by increasing the number of faces in the multi-faced trap. A comparison between the Perch fishery resources of Gulf of Mannar and Palk Bay indicates that the latter is more resourceful than the former. Some of the probable factors likely to cause a disparity in the Perch catches between these two areas are discussed.

(Prabhu, M. S., Indian Journal of Fisheries, Vol. I, Nos. 1 & 2, 1954.)

HYDROBIOLOGY.

(i) The characteristics of the Marine Plankton at an Inshore Station in the Gulf of Mannar near Mandapam

The paper deals with the gross qualitative and quantitative changes in the plankton of an inshore station in the Gulf of Mannar. These changes are compared with those observed at other places along the coasts of India.

Hydrological and meteorological features of the area are briefly described. Fluctuations in the surface temperature and salinity show similarity in general trends in the two years. The maximum and minimum surface temperatures recorded were 31.50°C and 24.00°C in 1950 and 30.60°C and 24.60°C in 1951 respectively. In 1950 the surface salinity was highest in May (36.41°/00) and lowest in December (29.44°/00). During the following year the lowest (29.01°/00) was recorded in January and the highest salinity for the year was 36.02°/00 in September.

The standing crop was on the whole of a higher order in 1950 than in 1951. It shows two peaks, one in February–March and the other during September–October, the actual months in which the peaks fall varying with the year. In 1950 and 1951 the standing crop reached its lowest level in December and October respectively.

The phytoplankton cycle shows more than one maximum during a year and the peak falling either in February or March appears to be the result of local flowering of a single species. In March, 1950 the species which bloomed suddenly was *Rhizosolenia alata* but in February 1951 it was *R. imbricata.* Several species of diatoms contribute to the summer as well as the August-November maxima and a list of these species is given. Seasonal variations of the more important species of dinophyceae and the planktonic blue-green algae *Trichodesmium erythroeum* are described.

A bimodal cycle in the distribution of Zooplankton with one peak falling sometime during February–April and the other in October is observed. The distribution and fluctuations of tintinnids, chaetognaths, cladocerans, copepods, decapods, pteropods, tunicates, larval forms etc., are discussed. As against the unimodal cycle of copepods described by investigators from other areas along the coast of India, there is a bimodality in their occurrence in the present instance.

While the results of the present investigation show that the local plankton has certain distinctive characteristics of its own, it shows some similarities with the plankton of East and West coasts of India, the probable reasons of which are briefly discussed.

The occurrence of the more important pelagic fish in and around the area of investigation for the two years is compared. It appears that the abundance of those species which feed directly on plankton shows some direct relation to the level of plankton population. The Mackerel when they occur in this area, feed mainly on copepods and Lucifer.

(Raghu Prasad, R., Indian Journal of Fisheries, Vol. I, Nos. 1 & 2, 1954)

(ii) **Growth requirements of Halophylic Blue-Green Alga,** *Phormidium tenue* **(Menegh)**

The effects of trace elements on the growth of the blue-green alga *Phormidium tenue,* cultured in both agar and liquid media, have been studied; and the complement of trace elements and the amount of each required for the best growth of the alga have been indicated. The growth of the alga in media of different pH ranges has been investigated. It was found that the alga exhibits optimal growth in the presence of B, Mn, I, and Fe in a medium having a pH 8.2.

The behaviour of the alga under varying degrees of salinity of the medium and its response to treatments with different trace-elements combinations have

been investigated. It was observed that the alga responds to treatment with trace elements and exhibits normal growth until the salinity of the medium reaches 8.5 per cent, beyond which range there is a definite fall in the growth rate.

The rate of growth as well as the absorption of nitrogen from the media have been studied in detail. The alga, in all probability, absorbs nitrogen from the media; and no evidence is obtained to show that it fixes atmospheric nitrogen when sufficient quantity of nitrogen is available in the media.

The maximum limit of salinity of the outside water that the algae can tolerate appears to be about 8.5 per cent. Within this range growth is normal and healthy if the trace elements Mn, B, I and Fe are present in a definite concentration and proportion; but beyond this salinity there is very little growth. The presence in excess of S O4 in the media, however, appears to prevent the toxicity of the high chloride content, to a limited extent, facilitating slow growth of the alga.

(Krishna Pillai, V., Indian Journal of Fisheries, Vol. I, Nos. 1 & 2, 1954)

(iii) On the life-history and ecology of *Hornellia marina* Gen. ET SP. Nov., (Chloromonadineae) causing green discolouration of the sea and mortality among the marine organisms off the Malabar coast.

The structure, life-history and ecology of *Hornellia marina* gen. et sp. Nov., a member of the *Chloromonadinae* are described in detail. The fagellate shows the following characteristics: body compressed, pear-shaped, broad and anterior with two flagella arising from the base of a narrow vacuolar reservoir at the anterior end, one directed forward and the other trailing close to the body; has a delicate undulated periplast, numerous bright green discoid chromatophores distributed all over the cell at the peripheral region except the posterior narrowed end and the nucleus prominent at the centre, shews, several glistening globules; highly sensitive and puts out wart-like protuberance sometimes. Vegetative reproduction takes place by longitudinal division and sexual reproduction by the fusion of two ordinary individuals of different sizes. This appears to be the first record of sexual reproduction in this class and this indicates an affinity for the class with the family Polyblepharidaceae of the chlorophyceae. The vegetative phase appears to be haploid, the diploid phase being represented by the zygote as in many members of the chlorophyceae, chrysophyceae and xanthophyceae.

The form occurs in swarms at times causing a green discolouration of the sea off the Malabar Coast of India and is associated with the mortality among marine organisms, fishes, crustaceans, etc. Similar observations made earlier on this coast are referred to and discussed in connection with the identity of the flagellate.

(Subramanyam, R. Indian Journal of Fisheries, Vol. I, Nos. 1 & 2, 1954)

INLAND FISHERIES RESEARCH

Progress of work done at Central Inland Fisheries Research Station, Calcutta for the quarter ending 30th June, 1957

The various investigations on inland fishery problems initiated in the three main sections of the station and in the newly established units were continued. Considerable progress was made in the organisation of Estuarine Survey centres in West Bengal and Orissa for collection of catch statistics. Two Hilsa Fishery survey centres have been established in West Bengal and Andhra.

The 10th Session of the Inland Fisheries Training Course commenced on 1st April, 1957 with 31 trainees.

Pond Culture Section

At Cuttack the entire Killa farm has been taken and remodelled for fish culture experiments, with special reference to fish breeding.

Experiments on fish culture in paddy fields at Cuttack indicated that Major Carp fingerlings could thrive in shallow paddy fields even without deep trenches giving a recovery of 28 to 57 per cent. with a maximum for *Catla,* but the growth was the lowest in this species and the yield of paddy was slightly less in stocked ponds.

The survival, growth and production data on Tilapia-Carp combination experiments at Puri Fish Farm are under study.

Studies on correlation between soil composition and fish production in ponds in Orissa and Madhya Pradesh showed that the general trend of variation of soil reaction, available phosphorus and available nitrogen as compared for different fish farms remain practically the same but in some cases the soil pH is slightly lowered and the available nitrogen shows an increase in summer months.

Weed control experiments on the effect of powerine and high speed diesel oil on *Salvinia* and *Pistia* showed that *Salvinia* was completely killed at the end of five weeks by the oils applied at the rates of 50 and 100 gls. per acre. Fernoxone was found not effective on *Hydrilla* and *Naias* even at a high rate of 50 lbs. per acre. Treatment with superphosphate at 150 ppm. and 10 ppm. of copper sulphate after lowering the pH was successful. The underground vegetative parts of *Hydrilla, Valisneria* and *Ceratophyllum* died within 50 days by application of 2, 4, 5-T and in 15 days with 100 ppm. of ammonium sulphate.

Riverine and Lacustrine Section

Fishery investigations in the River Ganga at Allahabad showed that *Hilsa* and Major Carp fishery registered a steep fall but *Hilsa* fishery was the most important contributing 39.4%, 54.5% and 36.2%, of the monthly catches of the quarter. Among Major Carp, *Cirrhina mrigala* was the dominant species and among cat fishes *Mystus* spp. were the most abundant. The fishery of shrimp was substantial only in June.

The pattern of fishery at Buxar was similar to that at Allahabad, *Hilsa* fishery being the most dominant. Major Carp fishery was steady and the Cat fish catches improved considerably.

Biological investigations on the fishery, food and feeding habits, sex ratio, maturity and fecundity and breeding of *C. mrigala, Labeo Calbasu, Mystus aor* and *M. seenghala* were carried out.

A survey of all the fishing villages along 390 miles stretch of the Ganga from Haripur to Babura was completed. Two surveys so far undertaken covering 630 miles stretch from Siyana to Babura show that the stretch of the Ganga, west of Allahabad District, is not productive while the stretch of the Ganga passing through Allahabad upto Babura is productive and fishermen employ varied types of fishing gear of considerable efficiency.

Water Pollution Unit has initiated work on toxicity of chemicals on aquatic animals.

At the Lacustrine Unit, a preliminary survey of the reservoirs of Tilaya and Konar (D. V. C., Bihar), Tungabhadra and Krishnaraja Sagar (Mysore) and Hirakud (Orissa) were conducted.

Chilka Investigation Unit

At this Unit, work was continued on survey of the lake fisheries, maturity and breeding studies of commercially important species of fish, compilation of fish export statistics, nature and location of the existing fishing grounds of the lake and studies on the fishing gear of the lake.

Studies on fishery of Chilka lake indicated that Prawns formed the most dominant fishery in both Central and South-Western and outer Channel sectors. Among Prawns *P. semisulcatus* was predominant species in North-Eastern Sector, *P. indicus* in the Central and South-Western Sectors, and both species in the outer channel sector. Among fishes, *Mystus gulio* was the dominant fishery in the North-Eastern Sector while *Mugil cephalus* formed an important fishery in Central, South-Western and Outer Channel Sectors.

Progress was maintained in the maturity and breeding studies of 14 commercial species of fish in the lake.

Fish export data from Gangadharpur, Kuhuri, Kaluparaghat and Bhusundpur from 1953 to 1956 have been gathered.

Estuarine Section

At the Estuarine Section, the report of the inventory of fishing units operating in the Matlah and the Rupnarain was completed and progress was made in similar work in the Mahanadi area.

The detailed analysis of the catch statistics collected so far is being carried out by the statistical unit. The Catch per unit of effort data for the two zones of the Hooghly showed that the highest of 49.2 lbs. was for the fishing unit Ganga Chhandi in the upper zone.

Analysis of commercial catches with special reference to age or size composition, maturity and feeding intensity of fish stocks in the estuaries indicated that juvenile *Setipinna* spp. and *Anchoviella* spp. constituted the bulk of the catches among clupeiods; *Gonialosa manmina* and *Gadusia Chapra* occurred in appreciable quantities of the upper zone and *Coilia ramcarati* and *C. borneensis* in the lower zone of the Hooghly; fishery for *Polynemus paradiseus* was restricted to the upper zone of the Hooghly; among Cat fishes mature fishes of *Osteogeneosus militaris, Trachysurus jella, Mystus gulio* and O year group of *Pangasius pangasius* were predominant; bulk of the catches of Bombay duck was obtained from the Matlah, while Ribbon fish catches were insignificant; 3 speices of *Palaemon, Leander Stylferus, Para penaeopsis* and *Metapenaeus formed* the bulk of the prawn and shrimp catches from the estuaries.

Hydrobiological observations in connection with availability of fish food organisms in the estuary and its correlation with the abundance of fish stocks indicated that plankton has been poor in all the zones of the Hooghly but richer in the Matlah estuary during the quarter.

Investigations on the *Hilsa* fishery showed that *Hilsa* collected from the Hooghly were all immature, those in Chilka lake were in the very early stages of maturity but those in the Rupnarain, the Ganga, the Padma and from Saurashtra coast were in advanced stages of maturity; while diatoms formed the bulk of the food of the Chilka *Hilsa,* Copepods formed the main constituent of the food of *Hilsa* on the Saurashtra coast.

Studies on the productive potential of brackish water bheris showed that the production of blue green algae was appreciable in the bheris at Sisirgunga, Mohanpore and Diamond Harbour, but green algae predominated in Taldi and Hasnabad. An assessment of nutrients in the water phase, soil-water phase and soil phase in the bheris showed that algal production does not indicate any direct relationship with salinity or contents of phosphorus, organic nitrogen, potassium, calcium and magnesium in the water phase; soil-water interphase relation with productivity is noted only with organic nitrogen while in soil phase algal productivity is related with phosphorus, nitrogen, and organic contents of bheri soil; there is a clear relationship between higher sulphide value of soil and higher productivity.

Pot culture experiments to study the requirements of benthic algae served to establish that the optimum salinity regime for the algae ranges between 5% and 15%.

Four scientific papers were published.

(Central Inland Fisheries Research Station, Calcutta).

(iii) Research programme undertaken at the Fisheries Laboratory, Uttar Pradesh.

1. Hydrobiological survey of Fishery waters. Under this, 86 tanks of the State have been surveyed and factors responsible for good and poor growth have been evaluated. This work is continued.

2. Studies on survival of fry of Major Carps in nurseries. Survival rate was found to be 15%. Further work on survival with different kinds of manure is under progress. Extensive studies on this problem is being carried out at C. I. F. R. S. and good results have been achieved.

3. Study of gut contents of about seven important fishes have been done to study the food and feeding habits.

4. Factors responsible for mortality of fish, are being studied.

5. Food value of Major Carps are being studied.

In addition to the above, for 1956-57 studies on weed control, fish diseases and parasites and factors influencing the spawning of Carps are also proposed.

HYDROBIOLOGY.

(i) Preliminary observations on the use of copper sulphate to control submerged aquatic weeds in Alkaline Waters.

Overgrowth of submerged vegetation is a common occurrence in fishery waters, while in manured nursery ponds this growth is extremely rapid, checking them up within a few days, if not checked in time. Any piece or water, if not managed properly, will be overgrown with weeds in a relatively

short period, adversely affecting the growth of Carps by limited moving space for the fish, and hinderance to fishing.

An attempt has been made to eradicate unwanted vegetation from nursery ponds by application of the cheap and easily available commercial copper sulphate. Owing to the lowering of the concentration of the Cu^{++} ions by the OH' ions in ponds with alkaline waters, this chemical is ineffective in killing weeds even at a high contration of 10 p. p.m. A temporary phase of withering is observed in the plants within th first few days of the application of the chemical but this phase soon passes off resulting in the revival of the vegetation in about 3 weeks. When copper sulhpate is added at a concentration of 10 p. p.m. after lowering the pH to 6.0, the reaction is quick and complete, visible signs of withering of the plants starting in 3-4 days, and all the vegetation decaying and settling to the bottom in about 25 days.

(Santimony Banerjea and Eva Mitra, Indian Journal of Fisheries, Vol. I, Nos. 1 & 2, 1954)

FOREIGN

GENERAL AND DEVELOPMENT

MARINE

(i) Record Herring Catch

British Colombia recorded the biggest Herring catch of 253,396 tons. Top producing area was Queen Charlotte area, with the catch of 92,637 tons.

The big catch resulted in a total yield of 47,000 tons of Herring meal and 4,391,000 gallons of Herring oil, besides other Herring products.

(Trade News, Vol. 8, No. 10, April, 1956)

(ii) Sizing up Canada's fisheries prospects.

The marketed value (value f.o.b. plants) of the industry's products approximates 200 million dollars annually. Some 92,000 persons are directly dependent upon the industry for their livelihood and in some areas it provides the only available source of employment.

The annual catch of fish and shell fish is around a million pounds, with all provinces contributing. In terms of marketed value (average 1950-54), chief producing areas are British Columbia (36.2 percent), the Maritime provinces (33.3 per cent.) and Newfoundland (18.0 per cent.). The balance is spread fairly over the Prairie Provinces and Northwest Territories, Ontario and Quebec.

About 35 per cent. of the total fisheries products is consumed in Canada and the balance exported. Some twentyfive countries are important consumers of products, by value, and the United Kingdom, the next most important single market with about 10%, is of primary importance to west coast producers.

(Canadian Fisherman, Vol. 43, No. 3, p. 12 March 1956)

(iii) New Guidance and Research ship launched

The new guidance and research ship *Sagami Maru* (680 tons), of Kanagawa prefecture, was launched in February 1956 at Shimizu. This vessel, built

at the total cost of U.S. $133,000 was under construction since the summer of 1955 and was planned since 1954, or immediately after the formulation of a fisheries agreement between Ceylon and the fishing industry of the prefecture. Its construction is another step in the programme of relieving the depression in the coastal fisheries by shifting effort to the high seas.

The new ship represents an increase of the prefecture's research potential, as compared with the old 160 ton *Sagami Maru,* and it has the most modern equipment, including a dispensary and a repair shop, so that it can perform the function of a mothership for Kanagawa Prefecture fishing boats operating in such distant grounds as the Indian Ocean.

(Commercial Fisheries Review, Vol. 18, No. 3, p. 42, March, 1956)

(iv) **The Japanese Fishing Industry.**

The total Japanese catch for 1955 will slightly exceed that of 4,924,939 tons for 1954. The Japanese fishing fleet is made up of 431,004 fishing crafts totalling 1,269,002 tons as of December 31, 1954.

Catches of Horse Mackerel, Mackerel-Pike and Tuna were high as compared with prewar records.

The entire Japanese fishing fleet consists of more than 139,000 powered vessels and approximately 2,90,000 non-power boats. About 6,000 ocean-going fishing vessels of all types are equipped with ship-to-shore radio, with range of upto 1,000 miles. Four thousand vessels have echo sounding equipment. Nearly 160 million pounds of nets and ropes are operated each year. Fresh frozen Tuna, marketed principally in the United States, stands above all other Japanese fresh frozen export products.

(Trade News, Vol. 8, No. 9, p. 15, March 1956)

(v) Republic of Korea—

The total landings of South Korea's fisheries in 1954 amounted to 248,287 metric tons. In 1953 landings amounted to 279,053 metric tons. Landings in 1955 consisted of 187,722 metric tons of fin fish, 41,565 of shelfish etc. 1,748 tons of whales and 17,252 tons of seaweeds.

The production of canned fish and other processed fishery products was not very significant.

South Korea's fisheries exports consisted of dried fish and shelfish, fresh fish and shelfish, salted fish and shelfish, agar-agar, laver, fish liver oils, canned fish and other miscellaneous fishery products.

South Korea's fishing fleet in 1954 consisted of 42,186 vessels of which 2,687 were fish carrier boats and the balance of 39,499 was actually fishing boats. Only a small percentage of the vessels were powered. In 1953 the fishing fleet totalled 42,584 vessels.

(Commercial Fisheries Review Vol. 18, No. 3, p. 43 March, 1956)

(vi) Fishing Industries—1954—French Morocco—

The salt-water fish and shelfish landing by French Morocco's fishing fleet in 1954 totalled 93.200 metric tons (valued at about U.S. $ 6.8 million ex-vessel) as compared with 127,996 tons (valued at about $ 7.6 million) in 1953 and 121,973 tons in 1952. The decline in landings between 1954 and 1953 was due primarily to a sharp decline in Sardine landings—76,582 tons as compared with 103,413 tons.

During 1954 approximately 75.6 per cent of the total landings were processed (canned, salted etc.) as compared with 77.7 per cent in 1953. In 1954 a large proportion of the Sardine catch was used for canning (61.2 percent in 1954 as compared with 38.9 percent in 1953) resulting in much smaller quantities used for reduction into fish meal and oil.

Although salt water fish and shell fish are landed at 8 ports, the ports of Agadir, Safe and Casablanca accounted for 87.9 per cent of the total salt-water landings in 1954, 88.1 percent in 1953, and 85.8 percent in 1952.

The consumption of fresh fish delivered by the French Moroccan non-industrial fishing fleet declined considerably in 1954. Casablanca continued to be the only important fresh fish market. In addition to deliveries by the trawler fleet, the French Moroccoan fresh fish market contniued to be supplied by ocean-going fishing clippers, two of which (the *EI Resk* and the *EI Marbrouk*) made several trips to Mauritanian waters during the winter months.

The 1954 industrial fishing season was seriously below normal with regard both to the quantity of the catch (principally Sardines) and the quality of the fish. The Scientific Ocean Fishing Institute played an important role during the 1954 fishing season, particularly with respects to its program for detecting and signalling schools of Sardines prior to the departure of the fleets for the fishing grounds. The 1954 Tuna catch was also great disappointment, since the tonnage delivered fell to little more than one-third that of 1953. The institute intends to conduct tests and experiments with a view to determining the methods of Tuna fishing best adapted to Morocean waters.

The industrial fishing fleet consisted of some 350 Sardine boats employing on the average a crew of 15 men. The largest Sardine fleet is located at Safi and bonserts of 133 vessels, Cirth a combined tonnage of 3,500 metric tons. The second fishing fleet is attached to the port of Agadir and consists of 127 vessels with 9 combined tonnage of 2,300 tons. The Casablanca fleet consists of 57 boats with a combined weight of 850 tons while the Mogador fleet numbers 14 vessels. In addition, from 3 to 7 boats are attached to each of the ports of Fedala, Mazagan, Rabat and Port Lyautey. The horsepower of motors varies considerably, the average weight of a boat is 20 gross tons and has an average speed of about 13 knots and is adaptable to deep sea fishing conditions.

During 1954 a total of 70,257 metric tons of fish was delivered to the processing industries, compared to 99,390 tons in 1953. In 1954 the French Moroccan canning industry produced 1,300,000 cases of canned fish, compared to 1,400,000 cases produced in 1953.

Exports of canned Sardines to United States declined; exports increased to French West Africa, British African Territories, Italy, Uruguay, Syria, Belgium-Luxembourg, Togoland and Great Britain. The export of fish meal and fish-oil declined in general.

(Commercial Fisheries Review, Vol. 18, No. 3, p. 35 March, 1956).

(vii) **Fishery Research Craft set record cruises**

A combined total of nearly 15,000 miles of cruising is a pretty good record for two fishery research vessels, operating from their Pearl Harbour base in Honolulu. Time involved was approximately three months.

The vessels are the *John R. Manning* and *Hugh M. Smith,* working on data on the oceanography and Tuna resources of the Equatorial Pacific.

The two boats performed a rescue mission in returning to Honolulu nine persons stranded at Palmyra Island by the grounding of the fishing boat, Commonwealth.

(Pacific Work Boat, Vol. 48, No. 3 p. 29, March, 1956).

(viii) The Norweigian Cod Fishery.

The Cod fishery goes on throughout the year in Norway. At present, there are about 20 large trawler (over 300 tons) in operation and the number of trawlers of less than 300 tons is quite large. The winter and spring Cod fisheries of North Norway are the occasion of great concentration of fishermen, vessels and gear. The peak of activity occurs during the famous Lofoten Cod-fishery. Operations commence about the end of January and continue upto April. Many types of fishing craft are used in Lofoten Fishery, ranging from small boats 20-25 feet long to decked vessels 60-70 feet. Handlines are the most popular type of gear.

The 1956 Lofoten Cod Fishery has been one of the most productive of recent years.

(Trade News, Vol. 8, No. 10, p. 25, April, 1956).

TECHNOLOGY.

(i) **A review of the microbiology of frozen and cured fishery products—**

Effect of freezing on the microbiological flora of fish.—(1) Freezing causes an initial drop of 60 % to 90 % in the number of bacteria present. If the storage temperature is below the minimum for growth the numbers of bacteria decline further during the storage. The heavier the initial load, the greater the number of survivors. (2) Freezing does not appear to affect the properties of the surviving micro-organisms because thawed fish spoil at about the same rate as unfrozen fish. (3) The rate of freezing has no effect on the numbers killed, but repeated freezing and thawing is more lethal than single freezing and storage in the frozen state for the same time interval. (4) Bacterial cells can be protected by the presence of colloidal materials, thus there is a higher mortality in distilled water than in broth. (5) There is a higher mortality of bacterial cells at the higher pHs, especially the strains which are sensitive to cold.

Effect of salting.—The preservating effect of salt is due to the restriction of the microbiological activity as a result of the dessication of the tissues; the direct action of Nacl on the putriactive micro-organisms present; the removal of oxygen and the sensitization of the micro-organisms to Co_2 ; the interference by the Nacl with the rapid action of the proteolytic enzymes. In pickle-curing, the flora consists mainly of halotolerant or halophilic micrococci, which grow easily in 10°to 15°C (50°F to 59°F) the brine counts increase rapidly over the first 10 to 15 days, and decline slowly to about 10% of the original number after 2 or 3 months and may remain steady at this figure for at least another six months. The flesh of the pickle-cured fish on the other hand, contains few micro-organisms, and soon become sterile.

In dry salting, the flesh at the wet-stack state always contains some micro-organisms, almost exclusively micrococci. There is little data on the flora of the finally dried product, but it is known that many halophillic types can survive drying and grow again when suitable moisture and temperature conditions permit. The flora of the final salted product is influenced greatly both in types and numbers by the flora of the curing salts. Manufactured salts usually contain few micro-organisms, but solar salts usually contain a rich and varied micro flora. Most Micro-organisms present in the salted fish fail to grow below 5°C (41°F) but at temperatures above 15°C bacterial activity by halophiles takes place. The halophiles consists of asporogenous rods and micrococci, which are highly pleomorphic. As a rule the optimum temperature for growth is 37° to 40°C (98.6 to 104°F.). Many are strongly aerobic, appear to grow well at a relative humidity of 75%, and can grow well at pHs. from 6 to 10. The problem of the mechanism of halophility is still unsolved.

Effect of smoking.—The 4 factors in the smoking process are: (1) brinning or salting, (2) drying, (3) treatment with smoke and (4) treatment with heat. Of the (4), smoking appears to be most important, affecting the keeping quality. Studies indicate that bacterial spores are more resistant to the action of wood smoke than the vegetative or non-sporing bacteria and that molds and their spores are highly resistant. The bacteria present in fish tissues are protected somewhat from the full action of the smoke, and sterility of the product is hardly ever produced in cold smoking. In hot smoking, the products from the kiln are nearly sterile, with only a few heat-resistant cocci remaining alive. It is still uncertain which group of the smoke constituents has the most effective bactericidal activity. Formaldehyde, tar fractions, fatty acids and phenolic fractions are among those which have been suggested as having the most effective bactericidal activity.

(FAO World Fisheries Abstracts, Vol. 7, No. 2, p.27, March-April, 1956).

(ii) Discoloration of canned crustaceans—

The discoloration of canned carustaceans usually appears as a faint grey or brownish tint. In very bad cases, blue or nerly black colors may be found. The discoloration is evenly distributed throughout the meat with higher intensity around the cavity from which the intestinal duct has been removed, and at places which have been injured. Other symptoms, such as off flavours, are seldom found in connection with discoloration, but no definite conclusion has been reached. The only certain fact is that no discoloration appears in the products with pH values of 6·5 or lower. In the pigment of crustacean blood, copper plays a part analogous to that of iron in the mammalian blood pigment. Lobster may contain as much as 170 mg. of copper/kg., the greater part of which, however, is removed during shelling and subsequent washing. Shrimp contain upto 15 mg., copper/kg. The corresponding values for iron are 4 mg/kg. in lobster and 25 mg./kg. in shrimp meat.

The fact that discoloration is most common in canned lobster indicates that the copper content is the agent responsible for the charge of color. Copper combines with amines present in the crustacean meat forming a blue compound. The amine content increases quickly in the dead tissue, particularly at places were bacterial activity is high. A similar increase of amines is found in semi-preserved crustacean products due to bacterial activity. Such products are nearly always discolored. The blue copper amine compond develops only in media with high pH values, i.e. above 6.5. Iron does not form colored compounds with amines and only under special circumstances does it combine with sulphur compounds. As copper binds sulphur compounds, forming a back pigment, combinations of iron and sulphur are

unlikely when copper is present. This gives more support to the theory that copper is responsible for the discoloration.

As mentioned above, the major part of the copper content can be removed by shelling and rinsing the shellfish. This provides some security against discoloration. The most important measure, however, is the additon of sufficient acid to the brine which may have the following combination when used for good fresh crustacean meat: 0.7% citric or tartaric acid preservative. More acid may be required for the canning of less fresh raw materials. The best pH range is between 6.2 to 6.4; the safest estimation of the pH is obtained by an electrometric pH apparatus.

The can material may cause discoloration through blackening. This may appear on the canned product. It is, therefore, advisable to use parchment linings in the case of tin plate cans, even when these are treated with sulphur resistant lacquers. Linings are unncessary in aluminium cans.

(FAO World Fisheries Abstracts, Vol. 7, No. 2, p. 41, March/April, 1956).

(iii) Humidification of cold stores: The Jacket System. Principle of the jacket system.

Refrigerated air is circulated through a jacket or system of ducts entirely surrounding the room instead of being circulated around inside. The vapor pressure difference between the product and the refrigerated surfaces, therefore, is not directly dependent on the external heat load or the operation of the refrigeration system. Temperature variations in the jacket, heat loads in the room, and uneven air flow distribution in the jacket all tend to lower the relative humidity in the room.

The test room.

A test room 10X10X20ft. long was constructed, so that the results of the study could be used in the design of commercial cold storage rooms. An accurate room temperature was obtained by heating air of a constant ambient temperature to eliminate the effects of changes in refrigeration capacity before it entered the jacket.

Measurements.—Temperatures were measured with thermocouples. Relative humidity was measured by the wet-and-dry bulb method. Velocity and static pressures were measured with a micromanometer and Pilot tube.

Findings.—Room relative humidity, which was found to vary with the rate and direction of air flow in the jacket, decreased from 98%, at a high rate of flow (1,800 c.f.m.) to 89% at a low rate of flow (500 c.f.m.) in top-to-bottom circulation. In bottom-to-top circulation the decrease in relative humidity was gradual and did not exceed 2%, whereas in top-to-bottom circulation the relative humidity decrease was abrupt at velocities below 1200 c.f.m. Smoke tests showed that air velocities inside the jacketed room were less than 5 linear ft./min. under all conditions. Special variations in room temperature were larger with bottom-to-top circulation. The average jacket temperature was about the same for top-to-botton and bottom-to-top circulation at high rates of flow. During temperature cycling tests the room temperature varied one third as much as the jacket temperature.

Conclusions.—The use of a jacket room will reduce surface dessication of the frozen products during storage to negligible amounts. The advantages of top-to-bottom circulation depend on uniform circulation in the jacket. With poor construction or insufficient circulation, bottom-to-top circulation may give better results. Jacketed room operation requires 10 to 15% additional power because of the increase in air circulation.

(FAO World Fisheries Abstracts, Vol. 7, No. 2,p.35, March/April, 1956.)

(IV) **Vaccum drying trails open up new era.**

It is stated that experiments have been successfully completed by an Aberdeen Scotland firm on a new process of dehydration, the vaccum-contact-dehydration process. It is being operated commercially. The new process preserves the fish in a form which it keeps almost indefinitely and regains completely its consistency and original flavor by soaking in water. The taste and smell of the reconstituted fillets are claimed to be indistinguishable from those of the original fish and the color of the product is light. Using the vacuum-contact-dehydration process, surplus fish can be dehydrated and preserved in good condition for use at any time in any part of the world. Both weight and bulk are greatly reduced and the product can be shipped as dry cargo. It is claimed that it can be stored for long periods under tropical conditions.

The final product is a small block of fish measuring only a few sq. inches and weighing a few ounces. After placing in water for 8 to 9 hrs., it becomes fully reconstituted and can be cooked just like fresh fish. Fresh or salted, whole or filleted can be vacuum dried.

(F.A.O. World Fisheries Abstracts, Vol., 7, No. 2, p. 37, March/April, 1956.)

(v) **A new process for the rapid manufacture of block ice.**

A new ice machine, produces a continuous column of opaque ice very rapidly. Water is first cooled in a vessel in which the sides slope inwards towards the bottom and which is surrounded by a refrigerant. The vessel may be square or circular in cross section. When the water in the vessel is frozen, a small amount of water is forced into it from the bottom, the pressure at the base of the ice block rises and since the crushing strength of the ice is greater than the bond between the ice and the freezing surface, the ice is torn from the surface and pushed up. The space between the walls of the vessel and the ice block then fills with water which freezes rapidly (1 min or less) since the film of water is only a few tenths of a millimeter in thickness. As soon as the film of water is frozen, a further small amount of water is forced in and, by repeating this process intermittently, block ice is manufactured continually and pushed up. Finally it is cut into convenient lengths. In this system the heat transfer from the water through the walls of the vessel to the refrigerant is approximately 50 times as great as that in the ordinary can-ice system. Thus the freezing time is very short and the manufacturing equipment is greatly reduced compared with that for block ice made in ice cans immersed in brine.

(F.A.O. World Fisheries Abstracts, Vol. 7, No. 2, p. 27, March/April, 1956).

(vi) **The influence of glazing and wrapping of Mackerel on the keeping qualities.**

Fresh ungutted mackerel were frozen in blocks of 8 for 1½ hours in an air blast freezer at an air temperature of −10°C. The final temperature of the fish was −25°C (−13°F). The mackerel contained 2.7% fat and 0.3% salt. After freezing, the average loss of weight was 1.2%. The blocks were glazed and wrapped in various ways but they were all stored in a container at −20°C (−4°F). without air circulation. At regular intervals, the samples were weighed and submitted to organoleptic testing after boiling.

Samples wrapped in sidac H.A.S.—cellophane did not decrease in weight for 22 weeks. For these wrapped samples, glazing was of no influence and the wrapping did not need to be hermetically closed. During the same time, the decrease in weight of unglazed and unwrapped samples was 3 5% and that of unwrapped samples glazed twice in water, 2.5%. Because the weight increased by 1.8% by glazing, the loss of weight of the fish itself was only 0.7%. Glazing

once in carboxymethyl-cellulose caused an increase in weight of 5.3%. During storage, 4% of the total weight was lost again. Oraganoleptic testing revealed that the keeping quality of the sample glazed with C.M.C. were best. The second best were the samples glazed twice in water and wrapped in cellophane. Both lots were still acceptable after 9 months. The unglazed samples were rejected after 5 months whether they were wrapped or not. The unwrapped samples glazed twice in water were unfit for consumption after about 7 months of storage.

It is concluded that wrapping without glazing is insufficient; dessication is inhibited, but not the development of rancidity. Glazing enchances the keeping qualities, especially glazing in C.M.C. (FOA World Fisheries Abstracts, Vol. 7, No. 2, p. 35, March/April, 1956).

(vii) Disinfectants and Bactericidal additives to the ice.

The great increase in the bacterial contents of the water of the fishing grounds due to the dumping of the offal into the sea may be avoided by collecting the offal in baskets and proccessing them in a fish meal plant aboard .The fish should be rinsed with water more thoroughly than upto now. Washing tests with chlorinated water in concentrations of more than 8mg./l. showed a yellowing of the fish flesh. With smaller chlorine concentrations no remarkable bactericidal effect was noticed. For improving the sanitary conditions of the fish holds a treatment of the wood planking with varnish is recommended. Lining of the fish holds with metal sheets proved to be still better. Further more, it is necessary to cleane the whole equipment of the fish holds thoroughly after each voyage by spraying with bactericidal solutions. For disinfection of fish processing factories, combinations of spraying with wetting agents and prolonged radiation with ultra violet light proved to be favourable.

(F.A.O. World Fisheries Abstracts, Vol. 7, No. 2, p. 25, March/April, 1956).

SOCIO-ECONOMICS.

(i) Mobile classes.

In Nova Scotia, the mobile navigation schools operate four week courses. Schools are limited to 15-18 trainees at a time. Like the navigation schools, the net and gear schools are at present held, where the fisherman learn to design nets, to alter designs and dimensions to suit the towing power and speeds of their boat and how otter doors and warps and nets themselves are likely to act in a given set of circumstances. Basic rules for splicing rope and wire are taught. Most classes are fitted into the off-season for fishing in the various districts. While they are attending the classes, the fishermen are given a subsistence allowance ranging from $1.50 per day for single trainees living at home to $3.75 per day for married men away from home. Novascotia's fishing industry is advancing very rapidly. By 1954, landed value of fish was more than four times the pre-war figure.

(Trade News, Vol. 8, No. 9, p. 7, March, 1956).

(ii) Salt Assistance Programme.

Hon. James Sinclair, Minister of Fisheries, Canada, announced that the Federal Government proposes to extend into 1956 the Salt assistance programme which was available to Atlantic coast producers of salted fish in 1955. Under the plan the government rebates to fishermen and plants producing salted fish products 50% of the cost of their salt, provided the products are not marketed

in the United States. Payments will be made to fishermen and plants operating in Newfoundland, Nova Scotia, New Bruswick, Prince Edward Island and Quebec. Under the 1955 programme between $400,000 and $500,000 has been or will be distributed to these producers.

(Trade News, Vol. 8, No. 10, p. 20, April, 1956).

CONSERVATION & MANAGEMENT.

(i) Investigation and Management of Atlantic Salmon in 1955 Part 2.—The Management Programme.

Surveys have been carried out on most potential Salmon streams in New Brunwick and Nova Scotia in order to provide an inventory of the present environmental conditions met by Salmon during their fresh-water residence. Data have been collected on the size and location of natural and man-made obstructions, sources and degree of pollution and the location and extent of spawning and nursery areas. Similar type of work have been carried in Labrador, and in Quebec. Data are also being obtained at selected sites to provide an estimate of the Salmon runs. Traps are usually placed at the upper end of fishways where the salmon are counted and released regularly. The information will be of considerable value in determining the use made of certain river areas by salmon in assessing the value of management procedures followed in such rivers and the effect of environmental changes on the Salmon runs brought about by industrial development. It will also provide a check on the annual fluctuations in the size and time of Salmon runs resulting from water temperature and flow.

The hatchery production of young Salmon for stocking selected waters in the Maritime Provinces was maintained at a high level in 1955. More than 9,100,000 Salmon fry, fingerlings and older fish were distributed. It has been observed that planting larger fish leads to better survival and greater return since the limiting effect of environmental factors is greatly reduced. Over 1200 of the selected stock will be planted experimentally in 1956 to determine their behaviour, survival and growth under natural environmental conditions.

A field experiment on a large scale has been undertaken to answer the problem whether early—or late-run adults produce early-or late-run Salmon respectively. Field techniques are being established to carry out predator bird control on a large scale ; work is also going on to determine the effect of certain industrial effluents in Salmon.

(Trade News, Vol. 8, No. 10, p. 13, April, 1956).

(ii) Dogfish Bounty.

The federal department of Fisheries has established bounty payments on Dogfish caught by British Columbia fishermen. The Bounty is a direct conservation measure and can be compared to the programme to eliminate the sea lamprey in the Great Lakes. Its purpose is to protect a valuable foodfish by the removal of a predator.

(Trade News, Vol. 8, No. 10, p. 22, April, 1956).

(iii) Investigation & Management of Atlantic Salmon, Part I Research Programme.

The Miramichi salmon fishery is restricted to the landing of large Salmon, weighing at least 5 pounds. Two methods are used, namely surface drift, netting offshore beyond a line between Neguac and Escuminac, and trap netting along the shores of Miramichi Bay and River upto the head of tide. The main angling fishery is for "bright" salmon coming in from the sea and weight 8-12 pounds and more. In recent years an early spring fishery for

descending kelts or "Black salmon" has gained popularity. The recent smolt marking experiments have shown that practically all the "bright" Salmon caught by Miramichi anglers originated in this river and were on their way to the spawning grounds.

Commercial salmon catches in the Maritime Region are inversely correlated with the average annual sea temperature. When these temperatures have been low the commercial catches have been high, when sea temperature has been high, commercial fishing success has been relatively poor. Experiments have shown that removal of mergansers and kingfishers can raise the smolt production five times or more by bird control, particularly by the control of mergansers.

Spraying of DDT in the Miramichi area to check budworm epidemic affected very seriously the young salmon population. The stream insects on which young Salmon feeds were also scarce in the sprayed areas particularly large mayflies, stoneflies, and caddishflies.

(Trade News, Vol. 8, No. 10, p. 6, April, 1956.).

MARINE FISHERIES RESEARCH

Fishing gear and craft

(i) Instructions for the preservation of the fishing nets.

The object of the preservation of the fishing nets is to protect them from rotting, to give them a color for improving the fishing yield, and to protect them from damage by sunlight. The preservation against rotting is most important. For that purpose the nets are soaked in tannin-containing extracts. To prevent these substances from being washed out, they are fixed on the net twines. The effect of the preservation can be increased by an additional treatment with tar oils. Cutch products under several trade names are preferred to the various other tannin containing extracts. Salts containing copper and chromate are used for fixing the tannin-containing extracts. Testalin is a special preparation. Of the tar-oils, Carbolineum is particularly preferred. Three methods of preservation are described when preserving the nets with Testalin, they are boiled for $\frac{1}{2}$ hour in a solution containing 2% Cutch and 1% Testalin. Then they are dried and boiled again for $\frac{1}{2}$ hour in a solution containing 4% Cutch and 1% Testalin and subsequently dried. With the "Dutch preservation" method, the nets are boiled for $\frac{1}{2}$ hour in a solution containing 2% Cutch, dried and then treated with a solution containing 1% $CuSo_4$ and enough liquid ammonia to make the solution dark blue and clear. After being dried, they are boiled again for $\frac{1}{2}$ hour in a solution containing 4% Cutch and then a second time in the 1% solution of $CuSo_4$. The "Spezialgerbung" process prescribes also that the nets be boiled for $\frac{1}{2}$ hour in a solution containing 2% Cutch and dried. Then they are put for 1 hour in a solution containing 3% $K_2Cr_2O_7$ and very carefully cleaned. After being dried, the nets are cooked for $\frac{1}{2}$ hour in a solution of 4% Cutch, dried, and then again treated with the $K_2Cr_2O_7$ solution. After all the three treatments, a soaking in Carbolineum is considered advantageous. (F.A.O. World Fisheries Abstracts, Vol. 7, No. 2, p.17, March-April, 1956).

(ii) Preliminary Report on Exploratory Long-line fishing for Tuna in the Gulf of Mexico, and the Caribbean sea.

Part I. Exploratory Tuna Fishing by the Oregon

A two phase program began in 1952 to expand the knowledge of the Gulf-tuna potential and to furnish information on applicable gear and fishing methods. The results from the first two years of part-time work (1952-53)

using purse seines and live bait techniques were inconclusive. Several factors including weather conditions and the speed of the fish movement hampered purse seining. Live bait fishing was slightly more successful. Baiting operations with a trap lift net (Seibenaler 1953) in the south, east and north gulf demonstrated a readily available supply of Tuna bait.

(Commercial Fisheries Abstracts, Vol. 9, No. 4, p.1, April, 1956).

(iii) The measuring of load on trawl nets.

For making a trawl light as possible, it should be designed in such a way that the pulling forces acting upon the net are distributed as uniformly as possible. If this is attained, the net twine can often be made substantially thinner and consequently lighter in weight. The decrease in weight is particularly desirable, if, in place of the hitherto used natural fibre twines, twines of the more expensive artificial fibres are used. With a view to find the appropriate tensile strength of twine, the stress affecting the net twines in the meshes between the knots, during the fishing operation, was measured. The procedure consisted in replacing half a series of meshes in a typical Herring trawl with meshes made of very elastic, braided perlon cord. Under load, it contracts again, copper wires (0.3. mm. or 0.011 in. diam.) are inserted into these cords; when the perlon cords are stretched and subsequently regain their original length, these wires stand out from the retracted twines forming larger or smaller areas. After fishing, the perlon cord is loaded by a special stretching apparatus, until the copper wire lies again close to the cord. The degree of that load corresponds to maximum load acting upon the twine during the fishing activity. A range of 0 to 20 kg. (O. to 44 lb.) can be determined upto an accuracy of 1 to 2 kg. (2 to 4 lb.) Measurements with a Herring trawl (ground rope 180 ft. or 54.9 m.) indicated that the stresses in the meshes are lesser than suggested. In the corners of the bosom of the net, the greatest values were between 5 and 12 kg. (13.2 to 50 lb.), max. 20 kg. (about 44 lb.). Generally speaking, the values were below 10 kg. (22 lb.), even in the cod end. Sometimes the stresses of the net twines in the meshes during fishing amounted to 1 to 3 kg. (about 2 to 7 lb.) only.

(F.A.O. World Fisheries Abstracts, Vol. 7, No. 2, p. 19, March-April, 1956).

(iv) Fishing Craft.

This article deals with various aspects of German fishing craft, fishing gear and methods.

Trawlers.—The average duration of trawling between hauls are: North Sea, 6 hrs.; off Iceland, 3 to 4 hrs., Barents sea, 3 hrs. Two and a half to 5 tons are considered normal. The storage of fresh fish in ice is still considered the most suitable for trawlers. The trawler spends upto 2/3 of its life time as a floating working platform and must have superb seagoing qualities. In terms of Froude numbers, a trawler with a speed of 11 knots is equivalent to bigger passenger lines with speeds of upto 30 knots. Stability is most important and the safety and well being of the crew have to be especially considered. The author considers a trawler of some 52 m (170.7 ft.) length b.p., with 9 m. (29.5 ft.) beam, 550 r.t., 16,000 cu. ft. (453 m) hold capacity and 800 to 1,000 h.p. main engine giving a speed of about 12 knots, to be ideal. A general arrangement plan deck lay out, design and construction of a modern German trawlers is dealt with, with special emphasis on stability requirements and distribution of space.

Cutters.—They are mostly employed for inshore fishing and are actually, in their layout and use, to be considered as small trawlers. Cutters are mostly constructed of wood, and all are motorized. The possibility of designing Cutters with transom sterns instead of cruiser sterns without impairing their resistance characteristics of their seagoing abilities and the point that stern posts in wooden vessels should always be sharpened to avoid unnecessary power losses are stressed. Cutters are considered to be very economical crafts as they operate with a small crew (5 to 6) and are able to keep on fishing even in bad weather. A general arrangement plan and midship section drawing of a standard 24 m. (79 ft.) are given.

Luggers.—The lugger is used for drift net fishing. The net is set at dusk and the lugger drifts behind the net during the night. At dawn, the net is hauled and the catch is immediately gutted and usually salted and packed into barrels. The fish hold does not have to be insulated or refrigerated. Modern luggers are mechanized but they usually carry a quite extensive sailing area for drifting. Luggers land the best quality Herrings but they are only used during the season. In order to improve their economy. the combined drift and trawl lugger was introduced. This type, however, necessitates some important changes, such as provision of trawl winch, gallows, insulated hold and only a few and small hatches. The idea of such a combination boat is fascinating but it has the disadvantages of being too complicated and too expensive when used as a drifter and only partially successful when used as a trawler.

A general arrangement plan of a modern lugger is given together with dimensions and an illustration of a combination boat.

(F.A.O. World Fisheries Abstracts, Vol. 7, No. 2, p. 9, March-April, 1956).

GENERAL FISHERY NEWS.

1. *Dr. N. K. Panikkar, Appointed Fisheries Development Adviser to Government of India.*—Dr. N. K. Panikkar, Chief Research Officer, Central Marine Fisheries Research Station, Mandapam took over as Fisheries Development Adviser to the Government of India on 26th April, 1957.

2. *Training in Fishing Boat Construction.*—The Government of India established a training centre at Cochin on 1st July, 1957 under the supervision of Mr. Paul Zeiner, F.A.O. Naval Architect to train Fisheries Officers of the maritime states in designing and construction of improved types of small power fishing boats. Nine candidates most of whom were working as counterparts to the Naval Architects have been deputed by the States of Bombay, Mysore, Kerala, Madras, Orissa and West Bengal. The course is of six months duration.

3. *Etap of the F.A.O. training in India in Fish Culture of Mr. Fernado Obregon Fernandez.*—F.A.O. have requested the Ministry of Food and Agriculture, New Delhi to provide training facilities to Mr. Fernando Obregon Fernandez of Mexico in the field of fish culture in India at Calcutta and at the Central Inland Fisheries Research Sub-station at Cuttack to study the breeding and culture of the Indian Major Corps.

4. *Zoological Society of India.*—The new Executive Council of the Society has been elected as follows:—

President: Dr. M. L. Roonwal, Director: Zoological Survey of India, Calcutta, Vice-Presidents: Dr. H. S. Rao, Katpadi: Dr. G. S. Thapar, Lucknow;

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5. *Survey of the T.C.M. Fisheries programme in India.*—Dr. Richard Van Cleve, Director, School of Fisheries, University of Washington, Seattle, U.S.A. arrived in India in January, 1957 on a special assignment under T.C.M., for a period of three months to make a general tour of the various fisheries projects in India in which T.C.M. is interested for the purpose of the evaluation and to advise on future lines of the development in India.

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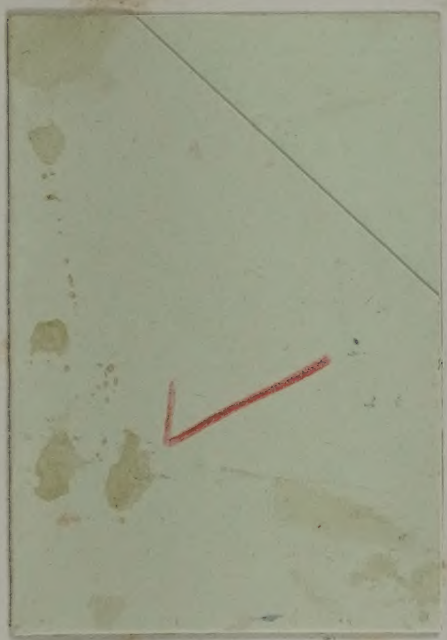

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